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FLYING

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Photograph courtesy American Airlines

How to make cleaning dirt-cheap

A conventional airline carpet, like the one in the aisle above, soaks up stains, traps dirt, gets grimy fast. Cleaning it is a difficult, expensive job. The carpet has to be removed and dry cleaned. Extra carpets must be kept on hand for quick replacement.

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This American Airlines' picture, which shows an Avtrim Flight Rug (under seat) and a conventional carpet side by side, tells the result. Things that are spilled on an Avtrim Flight Rug don't soak in, can be easily wiped up. Thorough cleaning can be done with soap and water, or any standard solvent, without removing the Avtrim rug.

Cheap, quick cleaning wasn't the only thing that B. F. Goodrich engineers had in mind when they developed the Avtrim Flight Rug. These rugs last far longer than conventional carpets. They're easy to install, don't wrinkle. The flame-proof sponge rubber backing provides cushiony comfort. The expensive-looking grains and glorious colors add new beauty to any cabin.

Avtrim is an ideal material for almost every interior trimming job. Many airlines use it for wall paneling, arm rests, baggage racks, bulkheads and other places.

For help with your decorating problems and for information on Avtrim applications, colors, grains and prices, write to The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.

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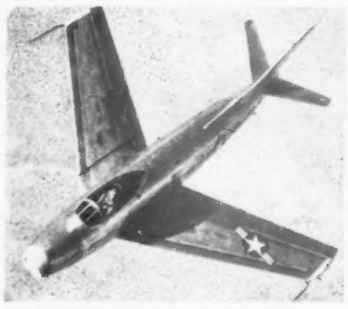

THE COVER: North American F-86, AF's fastest fighter has flown a record 670.981 m.p.h.

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THE MAIL BOX

THE MAN IN QUESTION

Would it be possible to obtain the name of the Air Force officer on FLYING's September cover?

CLARK E. HUGHES
First Lieutenant, USAF
Mather Field, Calif.

. . . He looks very much like Charles

. . . some wrong guesses.

Webb, who was a captain in 1944 at Courtland Army Air Field, Courtland, Ala.

FRANK L. MILLER
South Walpole, Mass.

. . . Is the officer with the CBI patch Malcolm Kirkpatrick? I last saw him in December, 1945, in Karachi, India. . .

JAMES J. CORNELY
Brooklyn, N.Y.

The officer resembles the co-pilot who was in my crew. I've compared pictures I made while we were serving together, but can't determine the identity definitely. . .

HORACE K. RICHARDSON
Atlanta, Ga.

● The Air Force officer examining the Republic *Rainbow* on September's cover is Capt. Morton B. Kelman, an ex-partner of the cover photographer, Harold G. Martin.—ED.

SUBMISSIVE PILOTS

Thanks for Hy Sheridan's enlightening column (September FLYING) on psychological tests for submissive traits of character.

When I answered a major airline's recent request for co-pilots I wondered why they were more interested in my answers to 378 screwy questions than in my 3,000 hours of flying over a period of 10 years.

At one point in the test these doctors of philosophy wanted to know if I had ever been forced into a fist fight since adolescence. There was no room on the quiz sheet to explain how I had to cool a joker for inciting a small riot in the back end of my C-46.

Similar questions appeared continually under the guide of new phraseology and circumstances. Since I am convinced this organization does not want an applicant who is man enough to skipper his own airplane, I am well satisfied with not being placed on their payroll. . .

Within a few years all the DC throttles in this land of Ph.D.'s will probably be on one desk with a psychiatrist pushing them. . .

CLIFF ROWLEY
Wading River, L.I., N.Y.

THE PITCAIRN ROADABLE

. . . Bill Stout's articles on "imagineering a roadable" are excellent.

It seems to me, however, that the helicopter is the only practical type for a roadable. Its advantages over the airplane are many:

(1) The helicopter can land almost anywhere.

(2) There are no wings to take off and put back on, or to fold and store. The blades can be folded back over the body.

(3) The helicopter can fly at slow speeds and would have advantages in congested areas.

Are there any plans for experimental roadable helicopters? If not, why not?

HAL THORLEY
Athens, O.

● The Pitcairn autogiro, now stored in a CAA hangar in Washington, D.C., is awaiting a place in the National Air Museum as the first roadable giro. It was one of three planes bought by the Bureau

. . . already imagineered.

of Air Commerce in 1934 in its effort to produce "a safer, easily-operated private-owned aircraft." It drives on the rear wheel and the blades fold back to fasten on the top of the fixed stabilizer for street travel. FLYING is not aware of any current efforts to produce a roadable autogiro or helicopter.—ED.

BRITISH BOUQUET

"Best yet" is my verdict regarding Test Pilot Herb Fisher's "I Learned About Flying From That" in October FLYING.

He catches the right atmosphere in his story. . . So often writers, and that includes skilled aviation writers, fail to

(*Continued on page 77*)

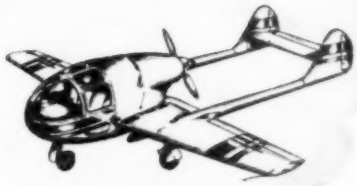
MOCK-UP FOR TWO FUTURES

This full-size wooden model of an airplane is taking shape under the hands of Northrop engineering students. When completed, the mock-up will be an exact likeness of an unusual new type of plane that may help mold the future of private flying. As a means of practical training in Aeronautical Engineering it helps mold the futures of hundreds of young men.

This mock-up is part of a typical Northrop training project. Students designed the airplane, prepared the working drawings, built the mock-up to check on their design, dimensions and specifications. They will make all the usual engineering tests, do all the production planning . . . in just the same way, with the same thoroughness, as engineers in an actual aircraft engineering department.

This practical training is preparing Northrop students to join the ranks of Aeronautical Engineers now designing the vast future of Aviation. Northrop graduates are stepping directly into design, research, testing, aerodynamics, and power plant engineering . . . some are in such advanced work as helicopter and guided missile design.

Northrop students know there is a big future in Aviation . . . and that their best bet is a career in Aeronautical Engineering. It takes them only two short years to get ready. Perhaps you would like the details.



The Airplane in the Making

Northrop aeronautical engineering students combined their ideas for the ideal private plane. A twin-boom pusher type, the propeller is placed between the two booms for safety from the whirling blades. The cabin arrangement permits pilot and passenger to step into the plane as easily as entering an auto. Another typical student project is design and construction of an all-wing glider.

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NOTES ON CIVIL FLYING

. . . **Skytours' Air Resorts** is a new organization of resort airports designed to advance air travel and raise the standard of accommodations for flying vacationers. Members include Air Holiday Inn, Groton, Conn.; Blaney Park, Mich.; Bradley Skytel, Boise, Ida.; Currier's Village, Lakeside, Ore.; Flying L Ranch, Bandera, Tex.; Gray Rocks Inn, St. Jovite, Que.; Honeymoon Isle, Dunedin, Fla.; Kings Gateway Hotel, Land o'Lakes, Wis.; Otis Lodge, Grand Rapids, Minn.; Red's Ranch, Wallowa Mountain, Ore.; Rocco's Villa Sunset, Blairstown, N.J., and Sky Lodge, Jackman, Me. More information can be obtained from Skytours, Inc., Box 120, Swarthmore, Pa.

. . . **Three state aeronautics** departments, plus the New England Conference of State Aviation Officials, have recently prepared detailed maps of airport locations within their boundaries. The state maps from Washington, Illinois and Colorado are elaborately printed in several colors, showing airways, airport locations and so on, with additional information on flying in their areas printed on the back of each map. The New England map has been published by Esso Standard Oil Company, Boston.

. . . **All Aeronca airplanes** delivered since October 4, 1948, have been equipped with the Safe Flight Stall Warning indicator at no increase in price. All Aeronca models equipped with the instrument qualify for reduced insurance premiums granted by at least five major insurance underwriters.

. . . **Revolutionary new engine** is the Wright Turbo-Cyclone 18, which employs a compounding system to recover energy from exhaust gases. The exhaust gases are used to operate a series of turbines which transmit power directly to the engine crankshaft. Great savings in fuel consumption are expected.

. . . **Luscombe** has started development of an agricultural plane specially designed for aerial spraying. The company expects the new plane, known as the *Silvaire Cropmaster*, to be ready by spring. It is based on the *Observer* design and will be powered by a 90-h.p. Continental engine.

. . . **Sky Service Corporation,** Evansville, Ind., has issued a pocket-sized airman's directory of midwestern weather bureaus, radio range stations and control towers. The booklet contains other information for flyers, including ground speed computer, sectional and world chart scales, instrument flight plan sequence, and weather symbols.

. . . **Suit has been filed** against the Veterans Administration by the Florida Aviation Trades Association seeking to compel the VA to ease its restrictions on flight training under the GI Bill of Rights. Harold A. Keats, national commander of AMVETS, also threatens to bring his organization into court to eliminate the red tape he says is tying up more than 64 per cent of flight training applications.

. . . **Rain-makers** who start rain by dry ice or other artificial means may be biting themselves off a flock of law suits, according to the Harvard Law School Record. Rain-makers might be liable for damage caused by floods, for example. Attempts have already been made by one Nevada rancher to register his appropriation of water rights in overhead clouds.

. . . **Civil Aeronautics Board** has instituted a general investigation of "large irregular air carriers," in response to complaints from established scheduled airlines that they are violating tariff regulations and operate too regularly and too frequently. Many non-scheds have been offering bargain fares between New York and the West Coast.

Girls of Cincinnati Wing Scout Troop 403 learn to fly in Ercoupe provided by Earl C. Sinclair. Ground courses are taught by Maj. James M. Huntsman.

IS YOUR PLANE WORKING THIS WINTER?

Here's how Navion stays on the job all year 'round . . .

CHRISTMAS TREE KING OPERATES AT SEASON'S PEAK WITH A RYAN NAVION

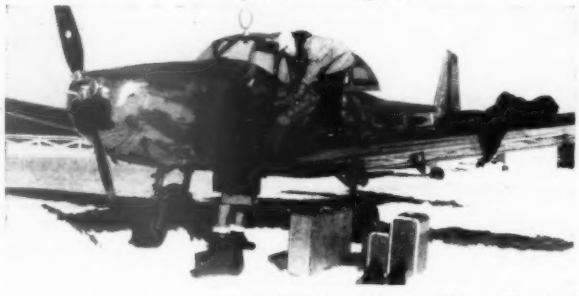
Roy E. Halvorson of Duluth, Minn., leading shipper of Christmas trees, says: "My *Navion's* amazing winter performance means I don't have to slow down during this important season. *Navion's* husky tricycle gear, high ground and propeller clearance get me in and out of rough, snow-banked fields with ease and safety."

ALASKAN BUSH PILOT KEEPS TO SCHEDULE WITH A NAVION

Robert E. Rice says: "Because the *Navion* can take off in a tail-low attitude, the nosewheel lifts quickly, making deep snow take-offs easy. And that rugged nosewheel prevents nosing over."

IDAHO MINE OPERATOR PROFITS FROM NAVION'S WINTER DEPENDABILITY

Bob Clarkson enthuses: "*Navion's* steerable nosewheel gives positive directional control even on icy runways. This baby's all-metal ruggedness means it flies when others are hangared."



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MILITARY NEWS

. . . **Convair B-36s** will have a 12,000-mile range within the next year. The world's biggest bomber is "the airplane for the strategic destruction of any conceivable enemy, anywhere, in any war within the next five years," according to Gen. George C. Kenney.

. . . **Alaska's first B-50s,** assigned to the Air Force's 43d Bomb Wing, are participating in field exercises at Eielson AFB, near Fairbanks. Three five-plane units will rotate on Alaskan duty until March 15, performing routine training missions such as navigation, bombing, formation flying and cruise control.

. . . **New commanding general** of the Air Force Division, National Guard Bureau, is Brig. Gen. George G. Finch of Atlanta. As head of the air units, Gen. Finch will continue to command the 54th Fighter Wing, which includes Air National Guard units in Georgia, Alabama, Mississippi, Florida, Tennessee, North Carolina and South Carolina.

. . . **Laid-off airline pilots** who hold commissions in the Air Force Reserve or Air National Guard can volunteer for active duty on the Berlin Air Lift.

. . . **A ring of radar** stations connected by television with a fire control office in the Middle West may be necessary if World War III comes, according to F. R. Lack, vice-president and manager of the radio division of Western Electric Company. Guided missile development is about the same today as that on the airplane at the end of World War I, he said, and in the next war a completely integrated system of defense will be needed.

. . . **An undisclosed number** of B-49A flying wing bombers will be built by Convair at Fort Worth. The eight-jet bombers, designed by Northrop, will be constructed at Convair's main assembly building, near the giant B-36 assembly line. Northrop recently signed a prime contract to deliver 30 B-49s.

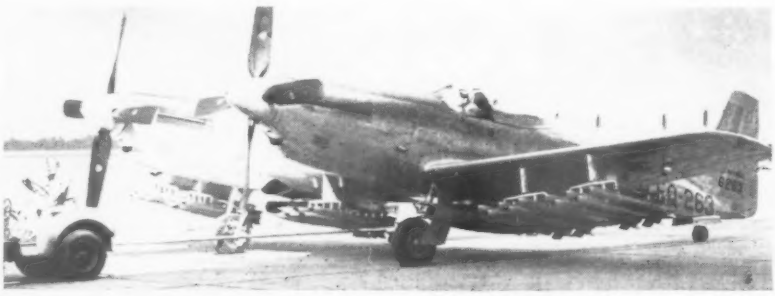
. . . **With heavy safety lines** attached to his body, Navy Lieut. A. L. Hall recently walked up to the nose of an FJ-1 running at full power. As part of a Medical Service Corps experiment, he was seeing how near he could get without danger of being sucked in by the powerful draft. He found that if extremely cautious, a person can get within two or three feet of the plane's intake without being sucked into it.

. . . **Helicopter flight tests** are underway on the Air Force's XH-15, a two-place liaison job. A bubble-like nose on the Bell helicopter provides good visibility for such jobs as photographic work, aerial inspection of power or communications lines, and regular liaison assignments.

. . . **Air Reserve** and National Guard officers can volunteer for three-year tours of active duty. Approximately 10,000 specially-qualified officers, most of them in non-flying fields, will be recalled during the next 10 months.

. . . **Modern combat craft,** among them an F-82 equipped with 25 high-powered rockets, were displayed to several thousand armed services officers recently at Eglin Field, Fla., during Operation Combine III. (See photo below.)

. . . **Pilot errors** in most cases are actually "designers' errors," according to Walter F. Grether of the Aero Medical Laboratory. Poorly designed instruments have made the pilot's task "excessively difficult," he says. To alleviate this problem, a number of U.S. Air Force instruments are being revised in design.



North American F-82, long-range escort fighter, carries 25 high-powered rockets under wings.

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☐ STRESS ANALYSIS AND DESIGN

NAME
ADDRESS AGE
CITY ZONE STATE
Check one: ☐ Veteran ☐ Non-Veteran

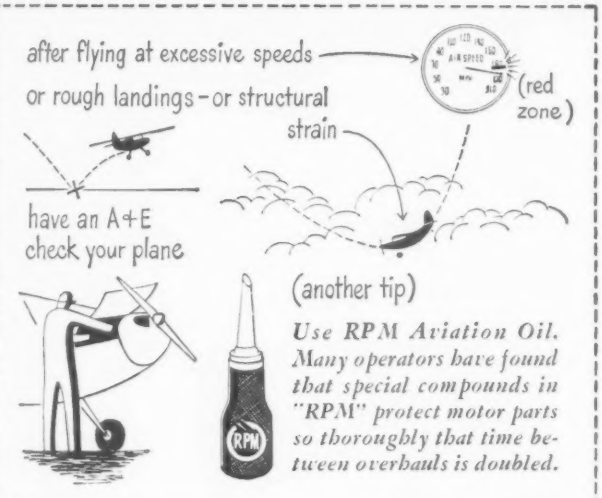
F-12

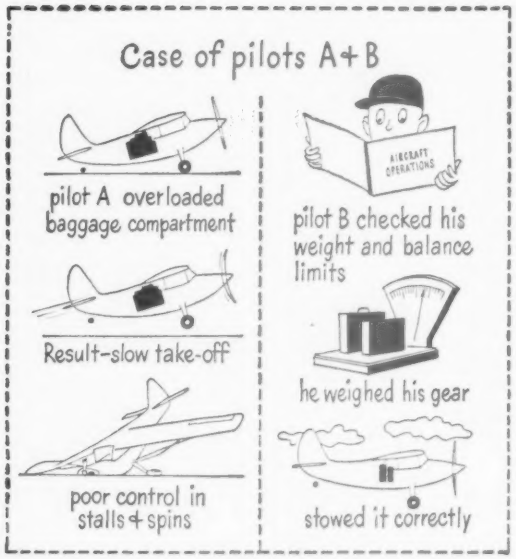
A page of service tips for private flyers and fixed-base operators

PLANE FAX

How to prevent costly repairs to your plane

If your plane has had some hard landings or undue strain during flight, don't wait for the regular periodic check-up. Have an A & E mechanic inspect it before the next take-off. In this way, you correct minor defects before they call for major repairs.


after flying at excessive speeds
or rough landings – or structural strain
(red zone)
have an A+E check your plane
(another tip)
Use RPM Aviation Oil. Many operators have found that special compounds in "RPM" protect motor parts so thoroughly that time between overhauls is doubled.
RPM


Case of pilots A+B
pilot A overloaded baggage compartment
Result–slow take-off
poor control in stalls+spins
AIRCRAFT OPERATIONS
pilot B checked his weight and balance limits
he weighed his gear
stowed it correctly

"We'll take better care of your plane"

Do you know how to load your plane?

Important thing to remember is distribution—*balanced* distribution of the load. Even though the total load may not exceed the manufacturer's limit, poor distribution may upset the balance and be a hazard. No less important is balance in your aviation gasoline. That's why so many fliers depend on Chevron Aviation Gasoline—scientifically blended to contain the right amount of light fractions to assure you easy starting and fast warm-up.

Lear

ORIENTER*

Automatic Direction Finder

(RADIO COMPASS)

Users Say:

"The Lear Orienter installed in my Bonanza is a great advancement in the navigation of all aircraft. I am proud of it. Regards,"
BILL ODOM: Roslyn, N. Y.
(Round-the-world Flyer)

"Thanks to the Orienter I saved 6 days on my return flight to Chile — due primarily to the long range accuracy of your direction finder,"
I. BUNSTER: Santiago, Chile
(Bunster & Bezanilla, Ltd.)

". . . Greatest instrument ever made to insure the lives of aircraft owners. I will never fly another plane without the Lear Orienter . . ."
FRED R. GEARHART: New York City
(Gearhart and Company)

"Your Lear Orienter is a wonderful piece of radio navigational equipment. It is the best I have ever seen . . ."
PAUL BUTLER: Hinsdale, Ill.
(Pres., Butler Paper Co.)

• Over the high peaks of the Andes, or across the varying terrain of North America, or around the entire world — the

Lear ORIENTER POINTS THE WAY

Pilots everywhere are enthusiastic in their praise of this reliable automatic direction finder. The Orienter is a real aid to navigation, is light in weight — only 24 lbs. — and gives airline radio performance in any aircraft. For complete details, write Lear, Incorporated, Grand Rapids 2, Michigan.

V. H. F. TRANSMITTER

A three-watt very high frequency transmitter unit which can be inserted in the same container with the Lear Orienter — weighs only twenty-one ounces.

Lear INCORPORATED

Only 24 lbs

*T.M. REG. APPL. FOR

Lear FIELD SERVICE

THE NAME MEN FLY BY*

50,000!

AOPA SETS NEW MEMBERSHIP RECORD

AOPA is the biggest organization of its kind in the world . . . and the *BEST* in the world say 50,000 AOPA members. By BEST these flyers mean the organization that gives them the most service, the best protection, saves them the most time, gives them the most flying convenience and saves them the most money! The record-breaking 50,000 memberships is important news to all private aviation. Never before has such a powerful united front opposed the selfish and misguided interests combating the development and advancement of private flying. Never before has it been possible for so many private pilots and plane owners to get so much for such a small investment.

50,000 of your kind of flyers have built AOPA into the kind of organization you'll be proud to join. Listed below, next to your membership application blank, are a few of the many features and privileges you'll enjoy as a member. In addition to these there are many more —such as the quiet prestige summed up in your winged lapel pin and the feeling of security brought by the knowledge that no matter where you fly there are always fellow members near you ready to give a hand or swap a yarn just like your friends at your home port.

50,000 memberships mean the power to flatten out a lot of the rough spots for private aviation. Come on in . . . the flying's fine.

SEND IN THE ATTACHED COUPON TODAY.

AOPA's J. B. Hartranft, Jr. (right) awarding membership No. 50,000 to Mr. and Mrs. David Stevenson of Washington, D.C. at Rehoboth Beach, Delaware, September 12 before an audience of more than 1,000 AOPA members and their guests.

Valuable AOPA Services FREE to Members

The Washington staff of AOPA will help you in personal flying problems, licenses, regulations, legal tangles, plane sales and purchases, documents, aircraft financing, employment. Also national AOPA-Hertz Drive-Ur-Self courtesy card; AOPA Washington Newsletter; each month the special AOPA edition of FLYING magazine; TWA-AOPA courtesy card assuring service and maintenance facilities at most TWA airports, advantageous aviation insurance service; distinctive AOPA pilot's wings, emblems for your plane and car, and membership card. Above all else, AOPA continuously protects and fights for your flying interests in government and other circles.

"AOPA"

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AIRCRAFT OWNERS AND PILOTS ASSOCIATION
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Washington Bldg., 15th and N.Y. Avenue, N.W.
Washington 5, D.C.

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All CAA-approved airplanes are safe and good...

ALL airplanes with CAA approval are airworthy—safe for pilot and passengers, meeting the CAA's rigid standards for public safety.

But these airplanes can and do vary considerably as to their relative value in performance per dollar of investment or in transportation per hour of the owner's time.

Here are the actual "strength" figures of the three leading four-place planes, together with "performance" figures. They explain the outstanding success of the Bonanza since its introduction, the loyalty and enthusiasm of Bonanza owners, and the Bonanza's consistently high resale value.

The following facts are taken from the CAA Approved Flight Manual or Operating Manual published for each airplane by its manufacturer. In order to make comparisons at similar altitudes, some of Plane A figures are interpolated from other data contained in that Manual.

Strength and Permissible Operating Speed

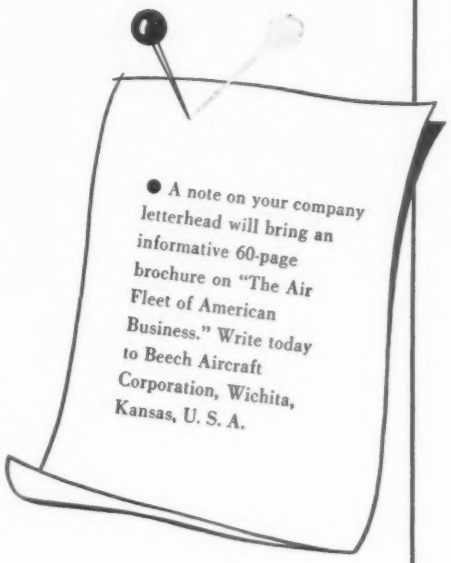
	Plane A	Plane B	Bonanza A35
Limit flight load factor, at full gross weight*	3.8	3.8	4.4
Ultimate flight load factor (at which failure may occur) at gross weight (based on CAR 03.201)	5.7	5.7	6.6
Placarded, never exceed, dive speed	158 mph	190 mph	202 mph

*Upper limit of the ratio of normal load to which the airplane may be subjected without incurring permanent deformaton and damage.

Performance

	Plane A*	Plane B*	Bonanza A35
High Speed, Sea Level	132 mph	157 mph	184 mph
Cruising Speed, 3500 feet	128 mph	150 mph	163 mph
Fuel Consumption at 3500 feet, gallons/hour, recommended cruising	10.8	12.0	9.5
Range at 3500 feet with standard fuel	540 mi.	495 mi.	670 mi.
Cruising Speed at 8000 feet	129 mph	144 mph	170 mph
Fuel Consumption at 8000 feet, gallons/hour	10.1	10.5	9.8
Rate of Climb at Sea Level	731 ft./min.	730 ft./min.	890 ft./min.
Rate of Climb at 8000 feet	240 ft./min.	310 ft./min.	515 ft./min.
Service Ceiling, feet altitude	10,400	12,000	17,100
Take-off distance, over 50 feet, Sea Level	2022 feet	1900 feet	1690 feet
Landing distance, over 50 feet, Sea Level	1916 feet	1300 feet	1155 feet
Stalling Speed, flaps up	64.5 mph	69.0 mph	65.0 mph
Stalling Speed, flaps down	61.5 mph	55.0 mph	56.0 mph

*The performance figures for both Plane A and Plane B are for planes equipped with optional, expensive changeable pitch propellers. The Beech controllable pitch propeller is standard equipment on all Bonanzas.



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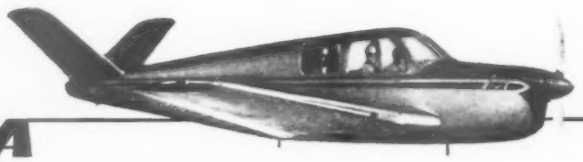

BEECHCRAFT
BONANZA
MODEL A35

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

JETS OF THE U.S. AIR FORCES

More than two score new jets are now flying. This is aviation's New Look.

Compiled by the Staff of FLYING

ON THE long hard runways of Rogers Dry Lake at Muroc and the concrete parking stands of Wright Field are an amazing group of new versatile jet airplanes. There are rocket planes; rocket plus turbo-jet planes; single- and twin-jet fighters; four-jet, six-jet and eight-jet bombers; propjets and combination piston-engine and jet planes.

Only a few are in production. The rest exist in prototype only—one or two or three of each—but they are the forerunners of a revolutionary new air force. Their higher speeds have doomed the propeller-driven planes of World War II. They have already made all conventional fighters obsolete and conventional bombers—even the B-50 and the B-36—obsolescent.

The accomplishment of the past few years is fantastic when compared with the plain fact that no American jet plane saw combat in the past war. Now, more than two score new jet aircraft types are flying from the decks of aircraft carriers or from land runways. They have brought with them completely new problems of aircraft maintenance, operations, and military strategy and tactics.

Until the advent of jet power, the speed of aircraft was always restricted by engine limitations. Today, for the first time, engine thrust has exceeded the ability of our airplanes to handle it. We have the power to drive airplanes

LATE U. S. JET MODELS

DOUGLAS SKYKNIGHT (XF3D)

McDONNELL XF-88

NORTHROP X-4

NORTHROP XF-89

into speeds beyond our knowledge of aerodynamics and construction to build them.

Moreover, we stand only at the threshold of jet development. As new, tougher and more heat-resistant materials are developed—particularly for the turbine blades of jets—and as better cooling methods are discovered—power will increase beyond anything we have today. But even that is fantastic.

The new jet planes break down into four groups: transonic research planes, jet fighters, jet bombers, and propeller-jet combinations in a variety of forms.

Research Planes

A comprehensive sonic research program is underway by the National Advisory Committee for Aeronautics in cooperation with the Air Force and the Navy Bureau of Aeronautics. Both rocket planes and turbo-jet planes have been and are being developed in collaboration with manufacturers and the services. Their purpose is to explore the still largely unknown transonic and supersonic speed zones. Three planes are already well underway with this program. They are the Bell X-1, which has already flown faster than sound, the Douglas D-558-1 turbo-jet-propelled *Skystreak*, which may have breached the sonic barrier, and the Douglas D-558-2 *Skyrocket*, propelled by a combination of turbo-jet and rocket power.

The X-1 and the D-558-1 are exploring the transonic zone. The Bell X-2 and the Douglas D-558-2, both with swept-back wings, will investigate the higher transonic speeds and get into supersonic speeds, along with the Northrop X-4, a flying-wing version. The Douglas X-3 apparently has not yet been completed but is intended to investigate the high sub-sonic speed ranges and get well into supersonic speeds.

These three groups of tests will take many months, and possibly several years. It is expected that combat types of jet craft will be flying faster than sound before the supersonic phase of the tests is completed. Design of supersonic planes is still an uncertain matter, even though the X-1 has flown faster than sound and the swept-wing North American F-86 is reported to have exceeded sonic speeds in dives. Our knowledge of transonic and supersonic aerodynamics is still rudimentary and the comprehensive research program is designed to find some of the answers.

Jet Fighters

Air Force jet fighters begin with the Northrop XF-79, intended as a ramming plane against bombers. Next on the list is the F-80—the Lockheed *Shooting Star*. The F-80 is still one of the two standard jet fighters of the Air Force. The third pure jet on the list is the Bell XF-83, a big long-range plane which weighs 12 tons. Its present status is extremely doubtful, however.

Next is the Republic F-84 (*Thunderjet*), which is the second (*Continued on page* 71)

See next eight pages for picture portfolio of 27 jet planes. Specifications of 48 jets on page 27.

LATE U. S. JET MODELS

DOUGLAS SKYKNIGHT (XF3D)

McDONNELL XF-88

NORTHROP X-4

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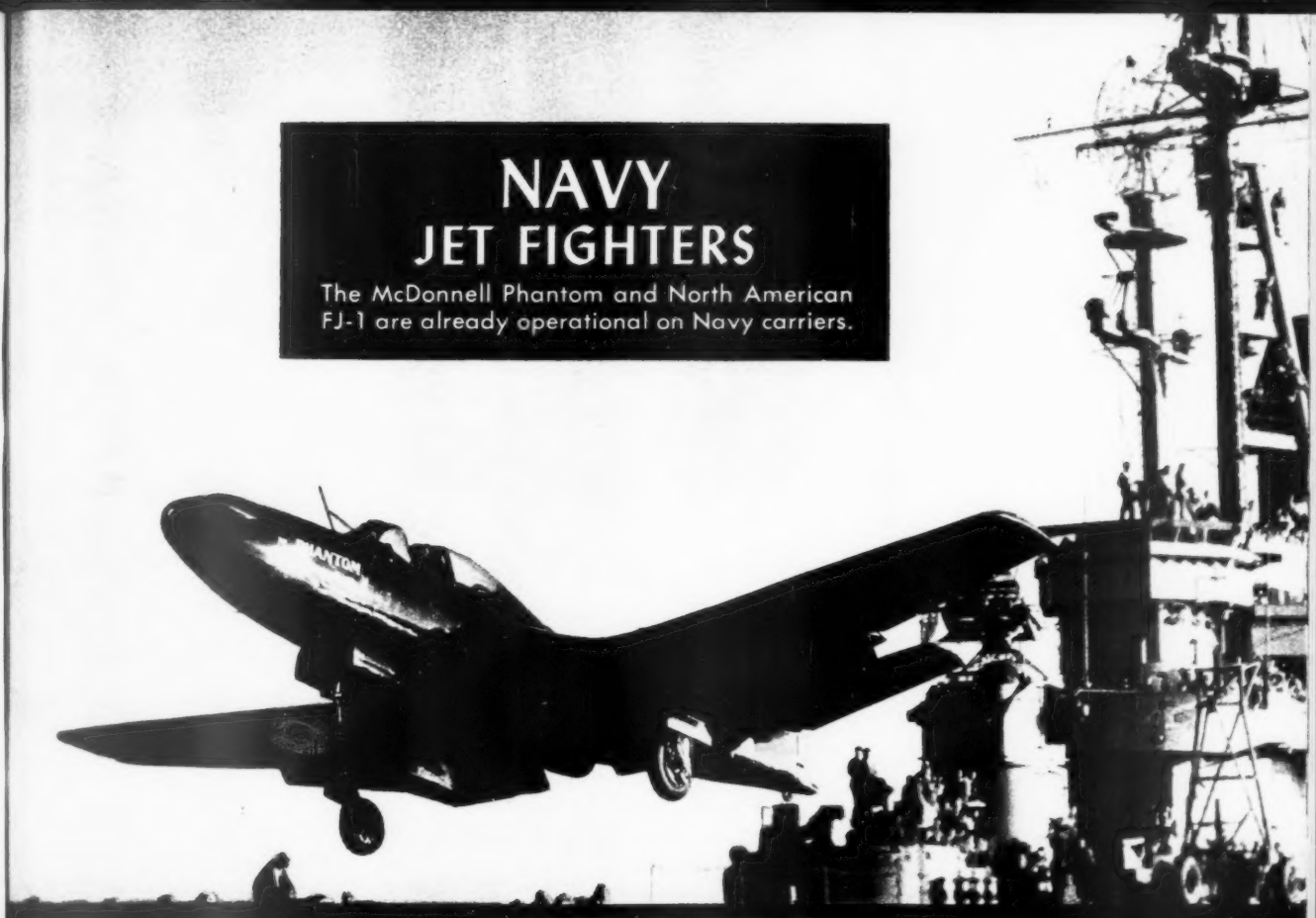
NAVY
JET FIGHTERS

The McDonnell Phantom and North American FJ-1 are already operational on Navy carriers.



McDONNELL PHANTOM (FH-1)

CHANCE VOUGHT PIRATE (XF6U-1)

NORTH AMERICAN FURY (FJ-1)

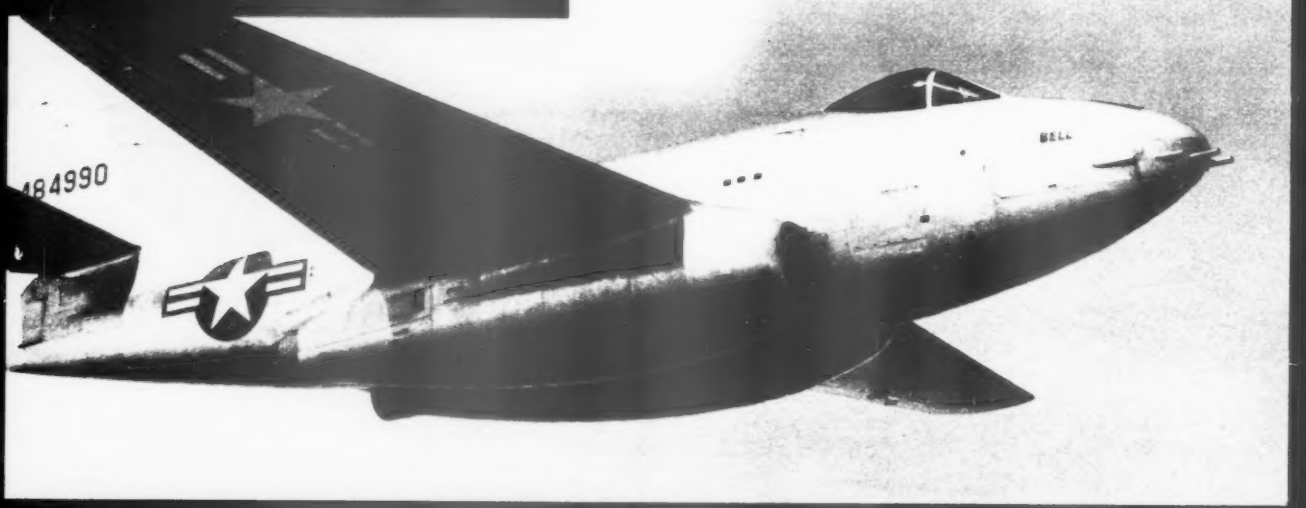
McDONNELL BANSHEE (F2H-1)

GRUMMAN PANTHER (XF9F-2)

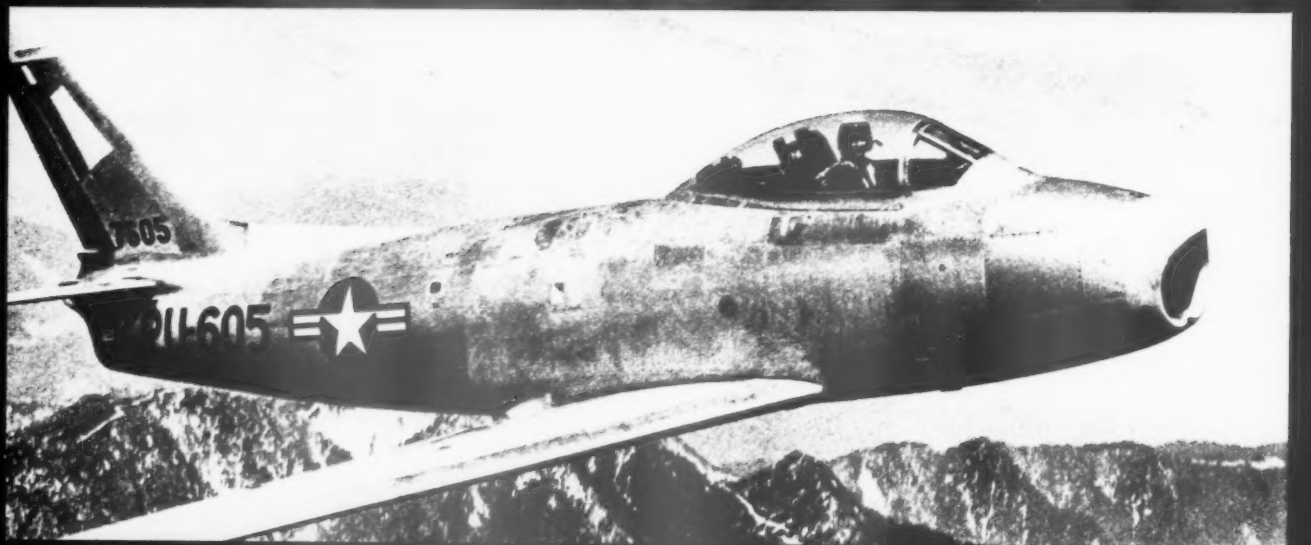
AIR FORCE JET FIGHTERS

They have made propeller-driven fighters obsolete and already approach sonic speeds.

LOCKHEED SHOOTING STAR (F-80B)



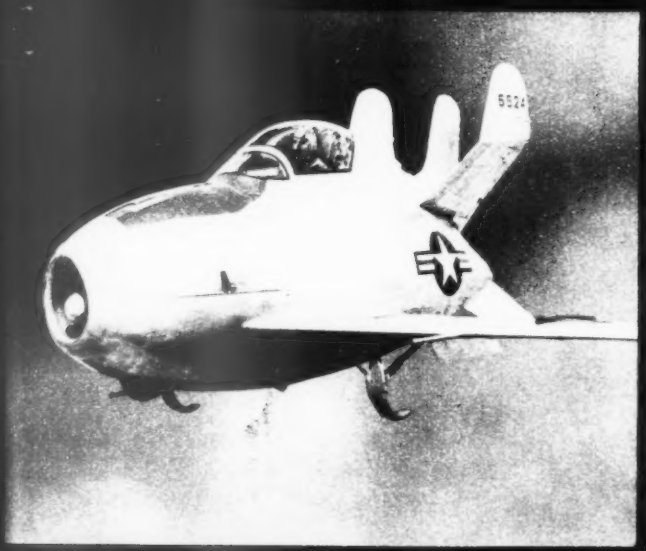
BELL XF-83



NORTH AMERICAN F-86

NORTHROP FLYING RAM (XF-79)

CURTISS BLACKHAWK (F-87)



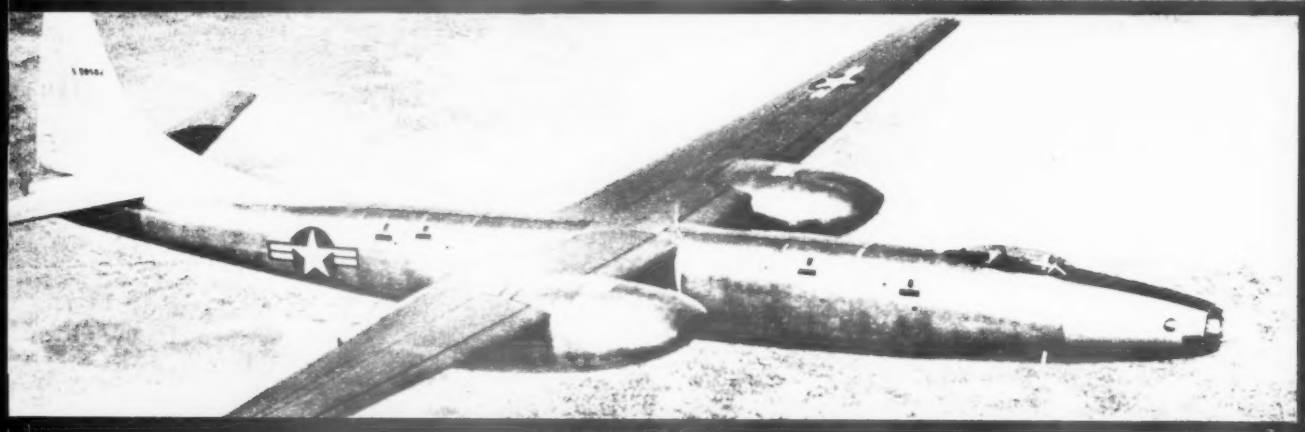
McDONNELL XF-85

REPUBLIC THUNDERJET (F-84)

AIR FORCE JET BOMBERS

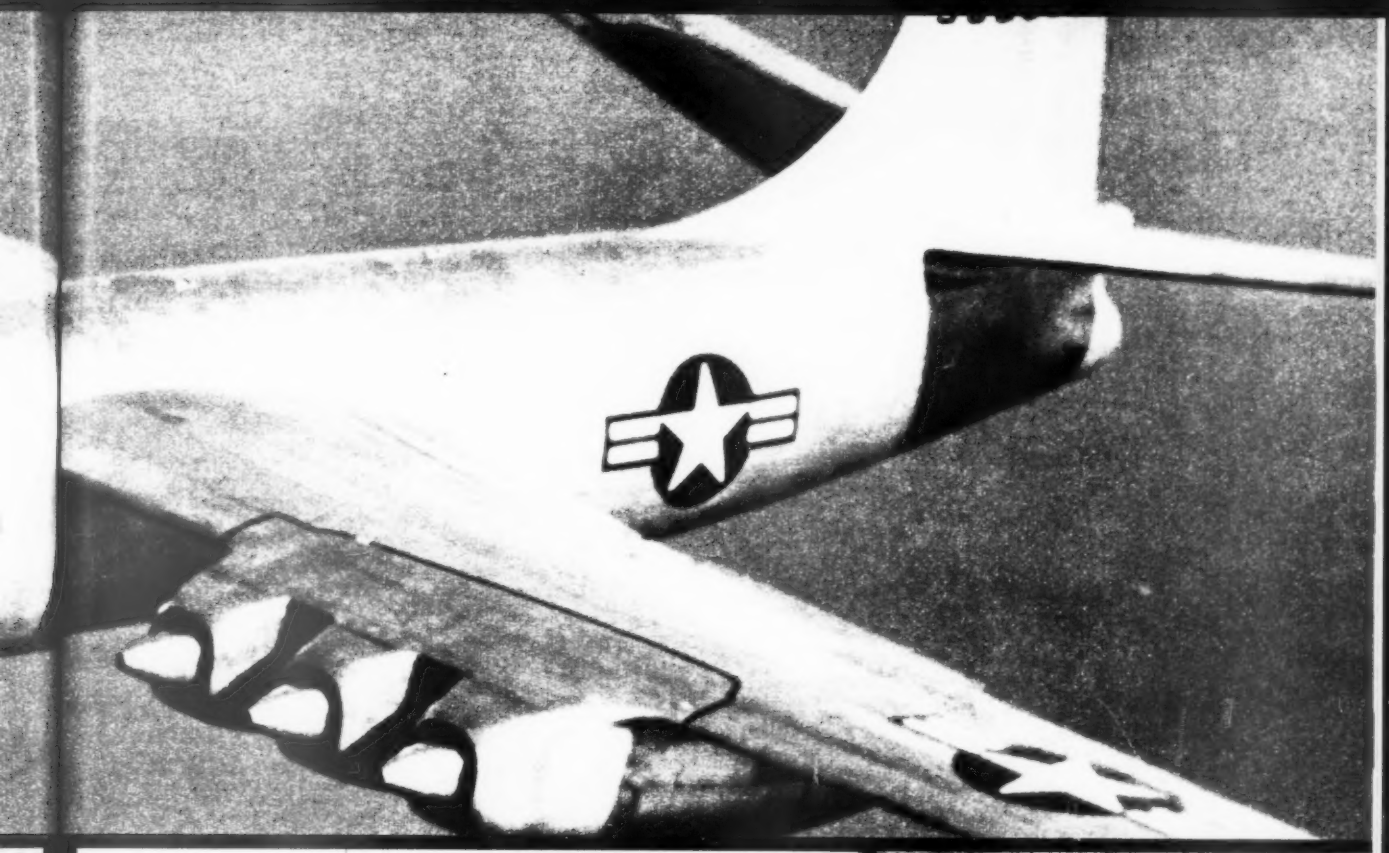
Jet power is making them almost as fast as fighters, but they still lack range.

MARTIN XB-48

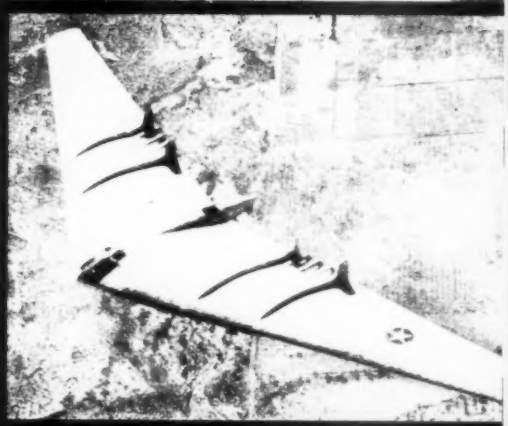


CONVAIR XB-46

BOEING STRATOJET (XB-47)



DOUGLAS XB-43



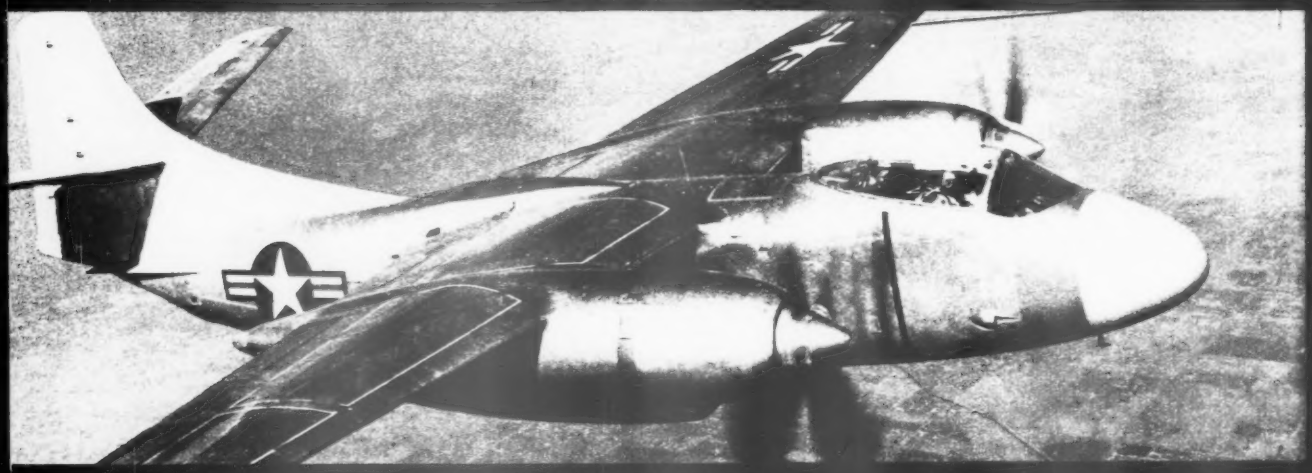
NORTHROP YB-49

NORTH AMERICAN B-45

COMBINATION
PROPELLER & JET

Props give them faster take-off, longer range; jets provide additional speed.

CONVAIR XF-81

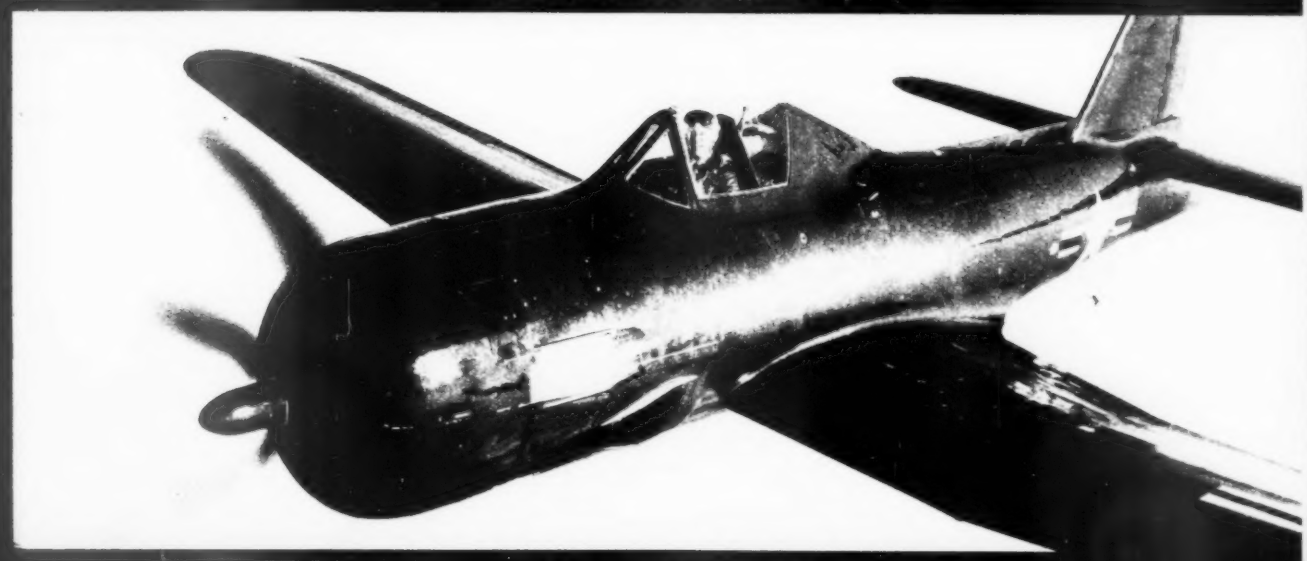


NORTH AMERICAN XAJ-1

RYAN FIREBALL (FR-1)

RYAN DARK SHARK (XF2R-1)

MARTIN MERCATOR (XP4M-1)

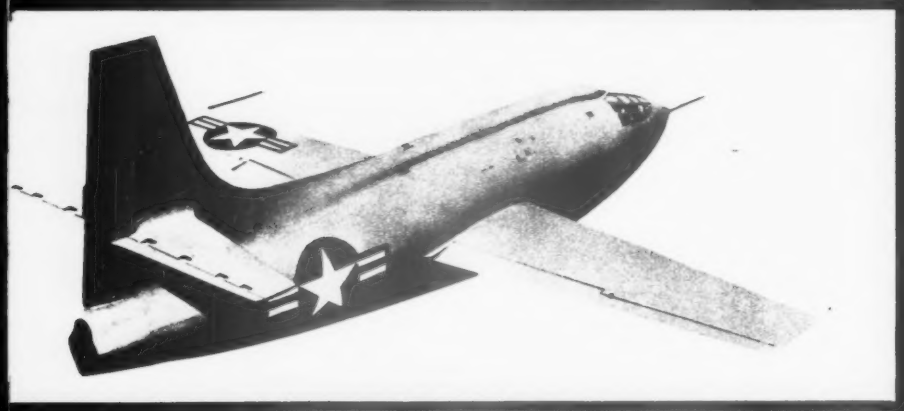


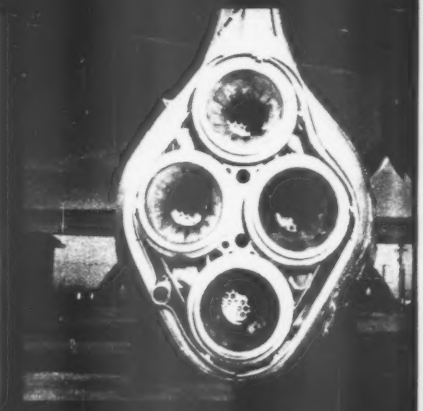
RYAN FIREBALL (XFR-4)

RESEARCH
JET AIRCRAFT

They use rocket and turbo-jet power to chart the course for future sonic planes.

DOUGLAS SKYSTREAK (D-558-1)





BELL X-1 and rocket cylinders

DOUGLAS SKYROCKET (D-558-2)

SPECIFICATIONS OF 48 U. S. JET AIRCRAFT

Manufacturer	Designation	Popular Name	Engines	Span	Gross Weight (lbs.)	Empty Weight (lbs.)	Max. Speed (m.p.h.)	Range (miles)	Service Ceiling (feet)	Armament	Remarks
AIR FORCE FIGHTERS											
Northrop	XF-79B	Flying Ram	2 Westinghouse 19XB	38'0"	,670	5,840	547	990	42,000	4 50-cal.	Flying wing, prone position, four-wheel gear.
Lockheed	F-80C	Shooting Star	1 Allison J33-A-23	38'10½"	15,300	8,200	600	1,250+	45,000+	6 50-cal.; 2-1,000-lb. bombs; 10 rockets.	First operational jet. More than 500 in service, with 457 F-80Cs on order plus 128 TF-80s, the two-seat trainer Has flown 623.8 m.p.h.
Convair	XF-81	.....	1 GE TG-100, propjet 1 I-40	50'6"	19,500	12,755	500+	2,500	.....	.....	Long range combination fighter with turbo-prop in nose and jet engine in rear. Not in production.
Bell	XF-83	.....	2 GE Type I-40	53'0"	24,090	14,105	500+	.....	.....	Forward-firing guns, bomb racks	Not in production.
Republic	F-84	Thunderjet	1 GE J-35	35'5"	16,000	9,000	600+	600+	40,000+	Forward-firing guns.	Second operational Air Force jet. Several hundred delivered, 409 F-84Cs on order.
McDonnell	XF-85	.....	1 Westinghouse J-34	21'0"	−10,000	.....	700+	.....	40,000+	.....	Parasite fighter designed to be carried in bomb bay of B-36. Wings fold. Only 15 feet long. In test stage.
North American	F-86	.....	1 GE J-47A (TG-190A)	37'0"	13,715	.....	650+	1,250	40,000+	.....	Swept wing (35°). Several built and 674 on order. Reportedly dived at sonic speeds. Holds world speed record.
Curtiss	F-87	Blackhawk	2 GE-Allison J-33	60'0"	.....	.....	600+	1,500+	35,000	.....	All weather, night fighter, originally with four Westinghouse 24C jets now being redesigned.
McDonnell	XF-88	.....	2 Westinghouse J-34	40'0"*	15,000	.....	650+	.....	.....	.....	Penetration fighter with swept wings. Twin-jet units in "belly-pod." Over 2,000-mile range.
Northrop	XF-89	.....	2 Allison J-35	50'0"*	30,000+	.....	600+	.....	.....	.....	Flying wing two-place night fighter, reportedly with remote-controlled gun turrets.
Lockheed	XF-90	.....	2 Westinghouse J-34 2 Rockets	.....	18,000	.....	680+	.....	.....	.....	Twin turbo-jets plus rocket booster engines. In development.
Republic	XF-91	.....	.....	.....	−15,000	.....	720+	.....	.....	.....	Allison J-35 or GE J-47 turbo-jet plus four 3,000-pound rocket engines. Five-minute combat range and 10-minute climb and cruise range. Intercepter fighter.
Convair	XF-92	.....	1 Westinghouse jet plus Rockets	35'0"*	−15,000	.....	800+	.....	.....	.....	Delta-shaped plane, with turbo-jet and six nitromethane rocket engines. Short range, possibly supersonic.
NAVY FIGHTERS											
Chance-Vought	F6U-1	.....	1 Westinghouse	30'2"	.....	.....	.....	.....	.....	.....	Tricycle gear carrier fighter. Skin is "Metalite," a sandwich material made of two thin aluminum sheets bonded to a balsa wood core. 33 on order.
North American	FJ-1	Fury	1 GE-Allison J-35-3 (TG-180)	38'1"	12,697	.....	550+	1,500+	.....	.....	Straight-winged plane, otherwise somewhat similar to Air Force F-86. Operational.
McDonnell	FH-1	Phantom	2 Westinghouse	40'9"	−10,000	.....	500+	1,000	37,000	4 50-cal. 8 rockets	Operational. Sixty have been built.
McDonnell	XF2H-1	Banshee	2 Westing. Yankee	41'6"	−13,000	.....	600+	1,200	48,000	4 20-mm. nose cannon.	Drag brakes. Provision for nose-kneeling. 179 on order.
Grumman	F9F	Panther	1 Rolls Royce Nene	.....	.....	.....	600+	.....	.....	.....	First two models will have Nene engines. Allison Model 400 (J-33) will be interchangeable in later planes. 317 on order.
Ryan	FR-1	Fireball	1 Wright Cyclone 1 GE I-16	40'0"	9,850	7,600	425+	1,400+	40,000	4 50-cal. 2 1,000-lb. bomb racks	World's first jet-plus-propeller aircraft, and Navy's first jet plane.
Ryan	XFR-4	Fireball	1 Wright Cyclone 1 Westinghouse 24-C	40'0"	.....	.....	500+	.....	.....	.....	Flying laboratory to test flush-entry type air ducts and the 24-C engine.
Ryan	XF2R-1	Dark Shark	1 GE TG-100 propjet 1 GE I-16	40'0"	.....	.....	460+	.....	.....	.....	Flying laboratory to test propjet engine, new propeller, etc. Propeller used as brake for shorter landings.
Douglas	XF3D	Skyknight	2 Westinghouse 24-C	.....	.....	.....	.....	.....	.....	.....	Twin-jet fighter, reconnaisance and attack fighter. Jet engines in belly pod. Bail-out through floor chute. 28 on order.
Grumman	XF10F-1	.....	.....	.....	.....	.....	.....	.....	.....	.....	Twin-jet fighter, reported.
Chance-Vought	XF7U-1	.....	.....	.....	.....	.....	.....	.....	.....	.....	Jet-propelled flying wing developed from XF5U "flying pancake." Nineteen on order.
McDonnell	XF3H-1	.....	.....	.....	.....	.....	.....	.....	.....	.....	Reported fighter with twin-jet units in "belly pod."
Convair	XFY-1(?)	Skate	.....	.....	.....	.....	500*	.....	.....	Reported rockets, cannon, bombs	Reported flying boat fighter with swept wings and twin jet units. May have butterfly tail.
AIR FORCE BOMBERS											
Douglas	XB-43	.....	2 GE TG-180	71'2"	40,000	.....	.....	1,400+	38,000	.....	Prototype attack bomber and first U. S. jet bomber. Tricycle gear. Pressurized cabin. Three-man crew.
North American	B-45	.....	4 GE-Allison J-35 (TG-180)	89'6"	82,600	.....	480+	2,000*	40,000	Over 10 tons bombs	First operational jet bomber. 190 on order. Two-man crew.
Convair	XB-46	.....	4 GE-Allison J-35 (TG-180)	113'0"	91,000	38,018	480+	2,000*	40,000	Bomb load 10 tons	Three-man crew. Still in test stage.
Boeing	XB-47	Stratojet	6 GE J-35 (TG-180)	116'0"	125,000	.....	600+	2,000*	35,000+	Over 10 tons bombs	Tandem gear with small outrigger wheels. Has 18 JATO rockets in fuselage. Two built and 10 more on order. Swept-back wings (35°).
Martin	XB-48	.....	6 GE J-35 (TG-180)	108'4"	102,600	58,500	480+	2,000+	40,000	Bomb load over 10 tons	Tandem gear with outrigger wheels. Three-man crew.
Northrop	YB-49	Flying Wing	8 GE J-35 (TG-180)	172'0"	200,000	88,100	500+	.....	30,000−	Heavy bombardment	World's longest-ranging jet plane. 13-man crew. 30 on order.
Martin	XB-51	.....	.....	.....	.....	.....	.....	.....	.....	.....	Possibly dropped.
Boeing	XB-52	.....	.....	.....	200,000+	.....	.....	10,000	.....	.....	Long-range heavy bomber with six turbo-props.
Convair	XB-53	.....	.....	.....	.....	.....	.....	.....	.....	.....	Reported former XA-44 with swept-forward wings. Three jet engines, near 600-m.p.h. speeds. Believed in suspension.
Boeing	XB-55	.....	.....	.....	.....	.....	.....	.....	.....	.....	Reportedly a whittled-down version of XB-52 with four turbo-props.
NAVY BOMBERS											
Martin	P4M-1	Mercator	2 P&W R-4360 2 Allison J-33	114'0"	78,000	.....	350+	3,000+	.....	.....	Patrol bomber. Piston engines in front and jets in rear of both nacelles.
North American	XAJ-1	.....	2 P&W Wasp Majors 1 GE-Allison Jet	.....	.....	.....	.....	.....	.....	.....	High-winged attack plane, folding wings for carrier operation. Three-place, pressurized.
Boeing	P3B	.....	.....	.....	.....	.....	.....	.....	.....	.....	Reported long-range patrol bomber project.
Grumman	XTB3F	.....	.....	.....	.....	.....	.....	.....	.....	.....	Projected torpedo bomber with piston engine in nose and jet in tail.
Convair	XP5Y-1	.....	Allison propjet	.....	.....	.....	.....	.....	.....	.....	Long-range anti-submarine patrol and rescue flying boat. Would have special fittings for crew comfort.
Lockheed	XP3V	Neptune?	.....	.....	.....	.....	.....	.....	.....	.....	Turbo-jet and propeller version of Neptune.
RESEARCH PLANES											
Bell	X-1	Airarocket	1 Reaction Motors four-unit rocket	28'0"	13,069	4,892	1,700 (design)	100	.....	None	Straight-wing craft. Has flown faster than sound and broken all altitude records unofficially.
Bell	X-2	.....	.....	.....	.....	.....	.....	.....	.....	None	Swept-wing rocket-powered plane designed for higher transonic and supersonic research. In development.
Douglas	X-3	.....	.....	.....	.....	.....	.....	.....	.....	None	Projected high sub-sonic and supersonic plane. May operate with 200,000-300,000-foot ceiling.
Northrop	X-4	.....	.....	25'0"*	7,000*	.....	.....	.....	.....	None	Swept-wing tailless plane designed for high subsonic research. Two turbo-jets.
Douglas	D-558-1	Skystreak	1 GE J-35 (TG-180)	25'0"	9,750	.....	.....	.....	.....	None	Transonic research plane. Magnesium alloy fuselage.
Douglas	D-558-2	Skyrocket	1 Westinghouse J-34 1 Reaction Motors rocket	25'0"	.....	.....	.....	.....	.....	None	Transonic research plane, swept wings, jettisonable cockpit. Has turbo-jet and rocket power.

*Approximately.

Flying the Jet...

TAKE-OFF Jets take off slower than modern piston-engined fighters because their high-speed jet streams are less efficient at low speeds than propeller slip streams. Fast propeller-driven fighters can outclimb jets to 15,000 or 20,000 feet.

Jets fly faster but that's only one way they differ from obsolete propeller-driven airplanes.

By HARLAND WILSON

JET engines of higher and higher thrust are coming off the production lines almost every month. Plane construction and strength ratios are improving. Wing forms are changing radically. Red lines are advancing farther and farther on the engine instruments, and mach meters are now standard equipment.

It may be dangerous, therefore, to be too specific in outlining the main differences between flying jet-propelled and conventional planes. Nevertheless these differences are substantial and it is high time that pilots who haven't yet had a chance to fly jets understand what they are.

Pilots flying jets for the first time are going to have to watch a good many new things and they will notice many differences. They will find that they can climb faster out of a dive than they ever dreamed they could climb in an airplane. They also can dive faster, and will have to be more careful not to exceed red lines in descent. They will have to be especially accurate in calculating their plane's range. They will seldom fly instruments. And they will come into a landing more cautiously than with propeller-driven planes for reasons which are inherent in jet flight.

Let's explain some of these differences, from take-off to landing. Let's find what they are and why they are.

When you take off for the first time in a jet airplane, you notice that acceleration is less than you are accustomed to. Your rate of climb is shallower. You won't really start to climb until your speed gets fairly high—say 300 m.p.h. or more. Your plane seems a bit sluggish at slow speeds and doesn't react too well to the controls. If you're in hilly terrain on take-off you have to be doubly careful.

The fact is that an F-51 or an F-63 will stay with a jet fighter for the first 15,000 feet or so. If it's got water injection it will probably beat it to 15,000 and maybe even to 20,000 feet.

The reason is that when your jet plane is going slow it doesn't have as much power reserve as a conventional plane. The jet stream it is shooting out the tail isn't as efficient at low airplane speeds as at high speeds. Accordingly, you need long, free runways, and you'll feel better about the good visibility and tricycle gear on your plane.

Once you do obtain speed and altitude, however, you'll climb faster than in a propeller-driven plane. Even if your angle of climb is the same, you'll climb faster because you're flying faster. But once you have that speed—for instance out of a dive—you can climb vertically for thousands of feet without much falling off in your mach number. And performance at altitude, of course, is vastly superior to a piston-engined, propeller-driven plane.

After you've levelled out you'll find this airplane more pleasant to fly. It's quiet with little or no vibration. On the Bell P-59 there was so little vibration they had to put a vibrator on the instrument panel to make sure the needles didn't stick.

That's a good thing, too, because jet flying requires greater alertness. Speeds are faster, hence time is shorter. Methods of navigation are streamlined because with older methods a pilot can be hundreds of miles off course before he realizes his error. One thing, though—you won't be flying in the soup. Jet fuel consumption is so great at low speed and low altitude that you can't afford the fuel to follow instrument let-down procedures. Fuel consumption at sea level is about three times that at 30,000 feet for any given r.p.m.

Contrary to general ideas, engine instrumentation on jets really is not simpler. Pilots have to watch new gauges, such as tail pipe and bearing temperature gauges, and they have to watch them closer. You'll have to be more careful in cruising your jet, because there isn't much difference between the maximum and the critical speeds. If you ever fly jets in combat this will be a difficult problem. The higher you fly, the narrower this margin is. Another combat problem is that speeds are so high that time on target is only momentary. You know how objects flashing by at the side are out of focus. At high jet speeds, the point of your focus is so far distant that your .50-mm. machine guns can't reach it.

On instrument flights in conventional planes, you must go first to your destination, and if that is impossible to your first intended alternate. After reaching that, your flight must be figured so you will still have a 45-minute fuel reserve. If you planned an instrument flight on that basis in an F-80 you wouldn't go anywhere. One trouble is that the obsolescent CAA regulations measure in time rather than in miles—and 45 minutes in your F-80 might be 400 miles at cruising speed.

If you fly at altitude you will find the flight uncomfortable. Your heavy crash helmet weighs your head down and is so big it may be bumping the canopy in rough air. Your oxygen mask is thoroughly uncomfortable, and you'll probably be wearing it even if your cockpit is pressurized. The F-80 is only mildly pressurized. Your "G" suit is binding and you'll probably be wearing a seat pack. Add to this the connections for all this equipment—for the receiver set inside your helmet, your microphone, oxygen mask, "G" suit.

In addition, you're wearing goggles, boots, maybe even a pressure vest. Your cockpit is crowded with instruments and controls. It's inadequately ventilated, heated, or cooled. Solar radiation through the canopy adds about 30° to the air temperature. The air ramming into the cockpit and the pressurization system heats by natural compression. You may turn on the nice fresh air but what comes out of the air duct is a hot blast. Cooling systems are getting better, fortunately, but until they get to be superb, a jet plane cockpit at high speed, and especially at low altitude, is just hotter than hell.

On a good hot day, at low altitude, your accelerometer is constantly indicating four to five Gs. These are sharp solid bumps, and you have to be strapped in tight. Add to all this that visibility is often bad . . . these are some of the problems of pilot comfort you must face as a jet pilot if you're not just taking a joy-ride at medium altitude.

All things considered, jets fly higher than conventional planes. But that doesn't mean your engine won't give you altitude trouble—indeed it may cause you more trouble than a reciprocating engine could. If your engine should cut out for some reason—as in momentarily switching from one tank to another—you can have the devil's own time starting it again.

CRUISING Jets cruise most economically at high altitude. They usually fly contact, but because of speed, pilots must be more alert in navigating.

LANDING Jets land at about the same speed as conventional fighters but they don't have the quick acceleration to get out again at full throttle.

You ordinarily wouldn't have much trouble re-starting a reciprocating engine under the same circumstances, but if your fire goes out in a jet never try to start it at altitude. You'll just have to come down before you try, or you'll wear your batteries out. And if you should fail to start it, you won't have much altitude left to play with. Combustion sometimes does fail at altitude. The Germans had a tiny auxiliary gasoline engine that they used to start their jets. It would run it up to idling speed, from which it would start satisfactorily. They didn't have the difficult starts at altitude or the treacherous hot starts that we have because our starters don't turn our wheels fast enough.

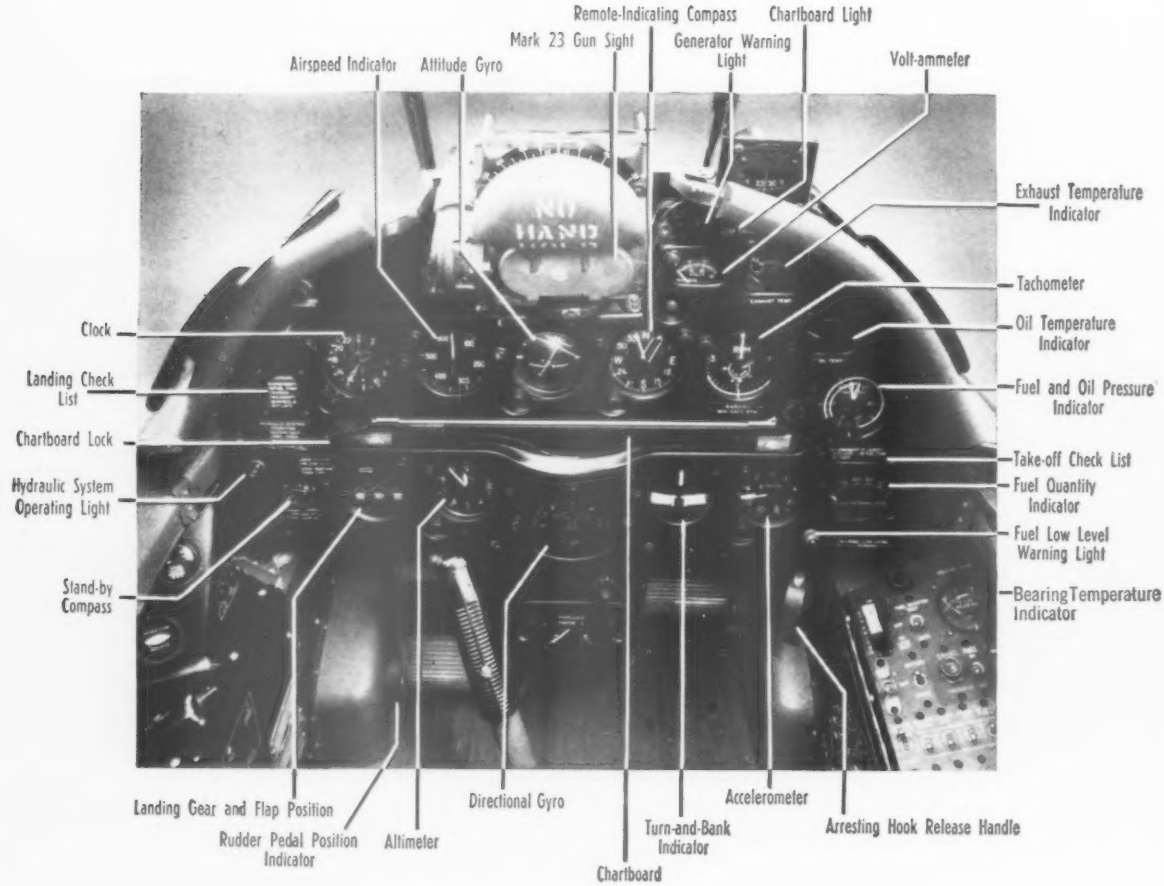
Turbo-jet engines have vastly more power than reciprocating engines. But more power takes more fuel. There is a very real difference between the two, however. As power and flying speed of the turbo-jet increases, specific fuel consumption decreases. The reverse is true of reciprocating engines. Since propellers show less efficiency at high speed there is a narrowing gap between the fuel consumption of the two types of engines. Finally, the jet catches up and goes ahead. The higher you go, the more you can retard your throttle on a jet.

Where does this leave us? At medium and low speeds, conventional planes burn less fuel. At extremely high speeds, the jets show a slight advantage—es- (*Continued on page 76*)

JETS ARE NOT *Simpler*

Compare a Navy jet fighter cockpit with a conventional fighter plane cockpit and see for yourself.

North American XFJ-1



DESPITE EARLY enthusiastic propaganda, jet cockpits are not simpler than those of conventional aircraft. The widespread idea that they are probably arose from the fact that *in principle* the jet engine is simpler than the reciprocating engine.

Close study of the instrument panels pictured on these pages will give you some idea of the differences between jets and conventional planes. The North American XFJ-1 (*Fury*), left, is a jet Navy fighter. The North American F-51H (*Mustang*), below, is a piston-engined Air Force fighter. The differences between these two planes are mostly those of function rather than of complexity.

Jets definitely are simpler as far as power controls alone are concerned. The jet pilot doesn't have to worry about propeller pitch or propeller feathering. And he doesn't have to worry about mixture control.

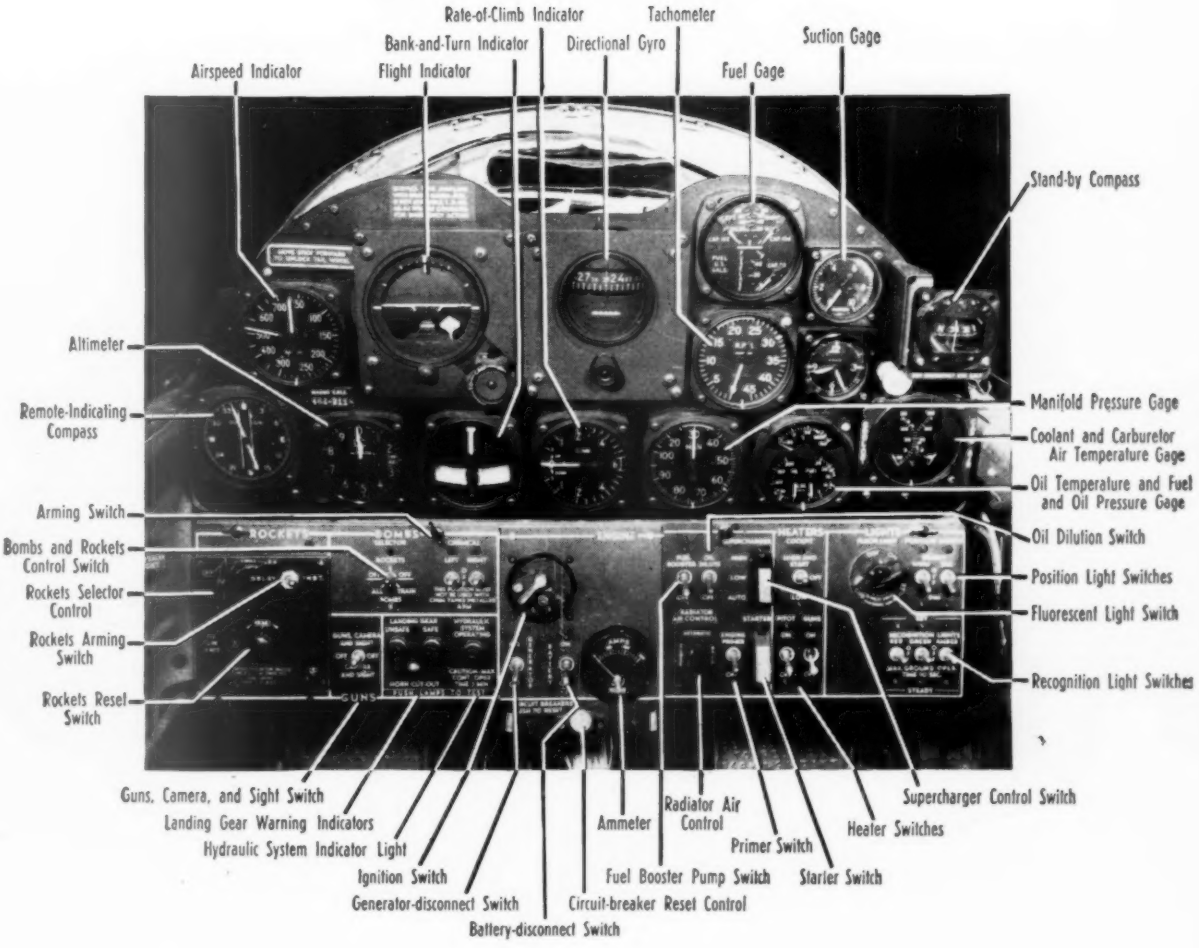
Engine instrumentation, however, is not simpler on the XFJ-1. The manifold pressure gauge and the coolant temperature indicator of the F-51H have been replaced by a tail pipe and bearing temperature gauges on the XFJ-1. A jet pilot still has to watch fuel pressure, oil pressure, oil temperature, and tail pipe and bearing temperature gauges. From a pilot's standpoint, the latter gauges are more critical and require more attention than either the coolant temperature gauge and controls (automatic on the older North American F-51H) or the manifold pressure gauge.

Flight and general system controls for both planes are identical. Armament and electrical controls vary with the type of equipment carried. Speed brake added to the XFJ-1 is an extra control not required in a conventional fighter. General arrangement and location of controls, switches and so forth on these two planes is determined more by the fact that one is an Air Force fighter and the other a Navy fighter. Most of the controls on the bottom of the F-51H console are duplicated on the right console of the XFJ-1.

All in all, it is just not true that jet cockpits have fewer "gadgets" than conventional cockpits. Cockpit installations are approximately equal. The main difference between the two is in the operational technique involved.

Handling qualities for each type are much the same, though each requires a different technique. A particularly desirable characteristic of jet flying is the absence of engine torque. The jet pilot will be less fatigued because of the lack of engine noise and vibration, and the overall quietness of jet-powered operation. The greater speed of the jet, however, demands greater pilot alertness. Jets are not necessarily easier to fly, then, and their cockpits are not simpler. END

North American F-51H



We can have jet lightplanes when we learn how to reduce fuel consumption.

Jets For Civil Planes?

By HY SHERIDAN

WHEN WILL our personal planes have jet engines? When will jets power the transports? Will jets always waste so much fuel? Are they inherently uneconomical? Can you simplify the mathematics of jet propulsion so that a fellow who has trouble adding his golf score or his income tax will be able to understand the principles?

Jet engines are here and it is important to know something about them. Imagine you are making a study of television (at a bar) and Sadie the Stewardess suddenly says, "Dear, dear, the squirts are wasteful." And the barkeep says, "He's a jerk, not a squirt." You can cut in with, "She is talking about jets, O'Toole, and mighty few guys know anything about them. All we have to do is triple the integral and widen the bustle and the problem of domesticating the jet is solved."

Now, that "bustle" item has more in it than you would think. The solution of the jet problem lies in that principle, as you shall see in a moment.

Ignorance of jet principles is by no means a private accomplishment. In fact if you think that you know more about jets than you really do, you are practically qualified as a jet engineer so far as I can make out by glancing around. For example, take the question: Is there something inherently wrong, some basic principle, that will make the jet engine always wasteful of fuel? I hear so many people say, as though it were an inevitable thing, "You can never use jets for civilian planes because they just are not economical." Using the simple facts exposed below you can decide that question for yourself.

It is well known that military jet planes use an awful lot of fuel, and that fact is not important to them because there are lots of taxpayers to pay for the stuff, but it is a different matter when it comes to the private owner and the airlines. When we pull up to get gasoline the guy wants money. Heavy duty jet engines can be made sturdy and reliable and easy to maintain, and they will be ideal power plants if we can lick the squandering of fuel. Therefore the answer to the question of whether you and I will have jets very soon is the answer to the question, can we sober up the jets so they won't drink so much? To answer this it is necessary to examine why the piston engine is the more economical at the moment, how each type of engine pushes the airplane forward, and what the mathematics are.

The piston engine and the jet engine push the airplane forward by taking advantage of the same physical principle, one of Newton's laws, which states that for each force there is an equal and opposite force. To push the airplane forward something has (*Continued on page* 58)

Jet transports such as Britain's Avro Tudor VIII have been built but are being used solely for research. They still waste too much fuel to be economical for commercial airlines. Hy Sheridan shows why the jets "drink" so much, and offers a possible solution to the problem.

Paint coat increased speed of the F-80 up to 25 m.p.h. in tests, but no paint is able to stand up under the wear of heavy rain storms or extended service.

DESIGNING THE F-80

The Shooting Star was a guinea pig for later operational jets.

THE Lockheed F-80 (*Shooting Star*) is America's first operational jet fighter. It probably has more operating experience than any other jet plane in the world. Because it was a guinea pig, the difficulties which were solved in building the F-80 emphasize the basic problems for aircraft of the future.

Lockheed had proposed a jet fighter design as early as 1939 and had done design work on a plane equipped with an engine of its own conception. Actual work on the F-80 was not assigned until June 23, 1943, however, when it became apparent that only another jet could compete with the new German types which were already operational.

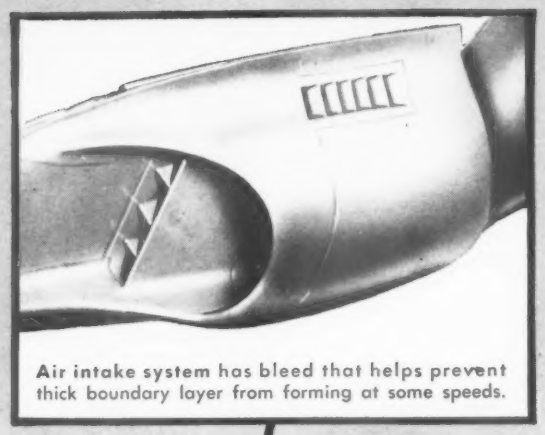
The first XP-80 was designed, built and preliminary ground tests were completed in 141 days. It was powered with a British deHavilland *Halford* engine of 2,500 pounds thrust, but production of the engine was not forthcoming. Immediate procurement of the F-80 type based on the original design, therefore, was impossible.

General Electric I-40's were available in this country, however. But to use the new engine it was necessary to redesign the XP-80 completely to make a new model, the XP-80A. This plane had a new, longer fuselage, 25 per cent greater weight, new ducts, new engine installation and so on. The XP-80A was then designed, built and flown in 138 days. Production followed closely. A few of the planes arrived in the European theater during the war but none actually entered combat.

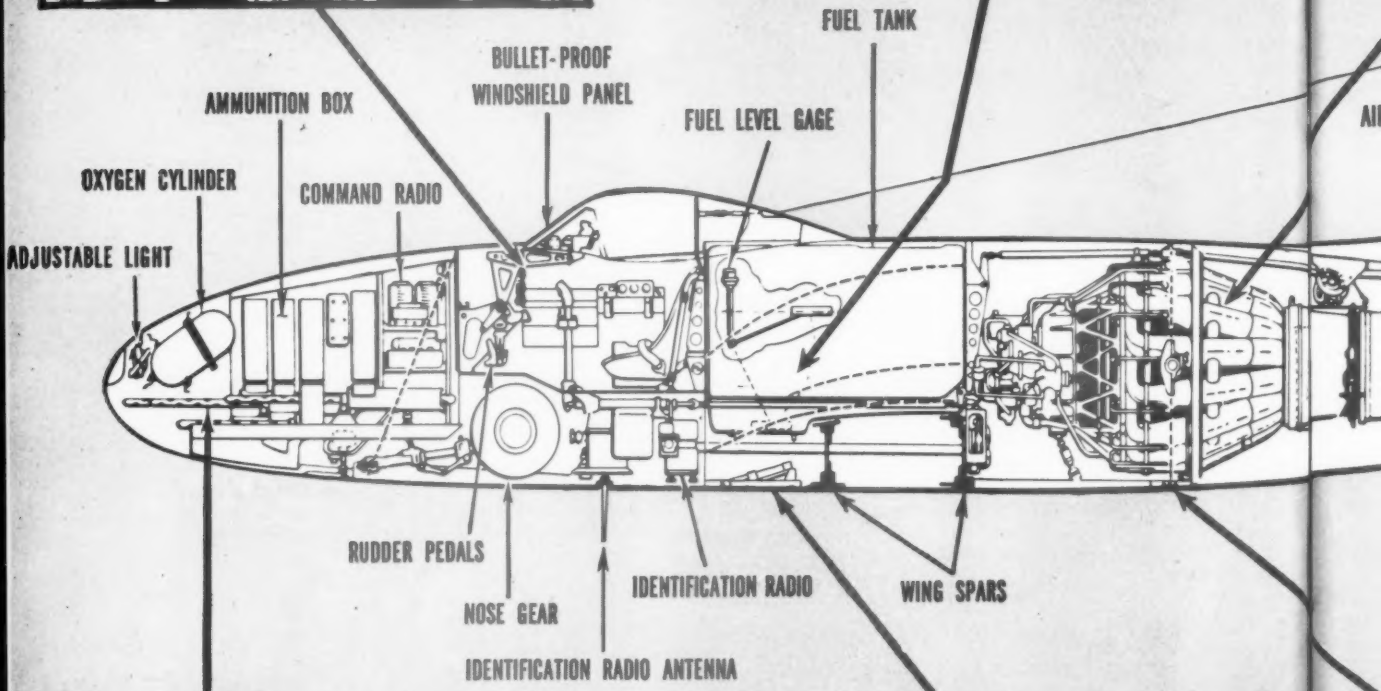
Here are some of the design problems of the F-80.

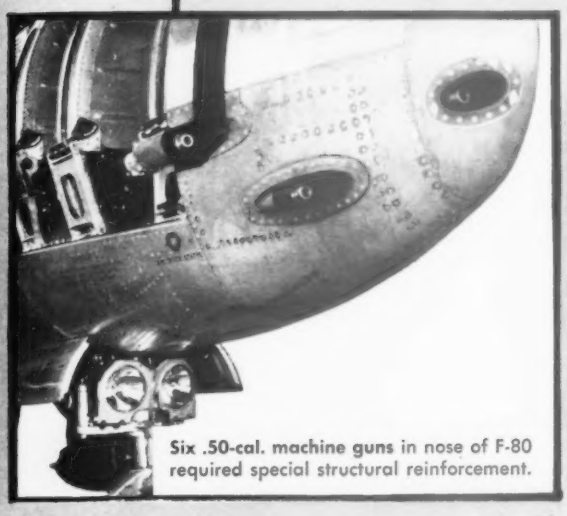
The power plant installation had to be accessible and

F-80 cockpit resembles conventional panel in many respects, but some of the engine instruments are different.

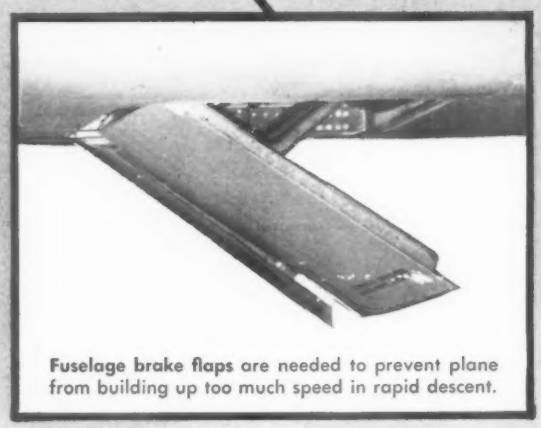


Air intake system has bleed that helps prevent thick boundary layer from forming at some speeds.





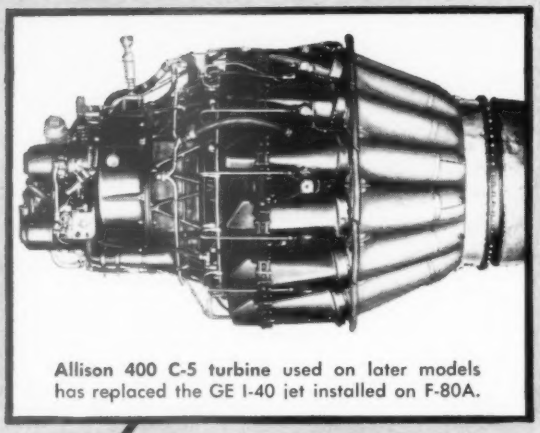
Six .50-cal. machine guns in nose of F-80 required special structural reinforcement.



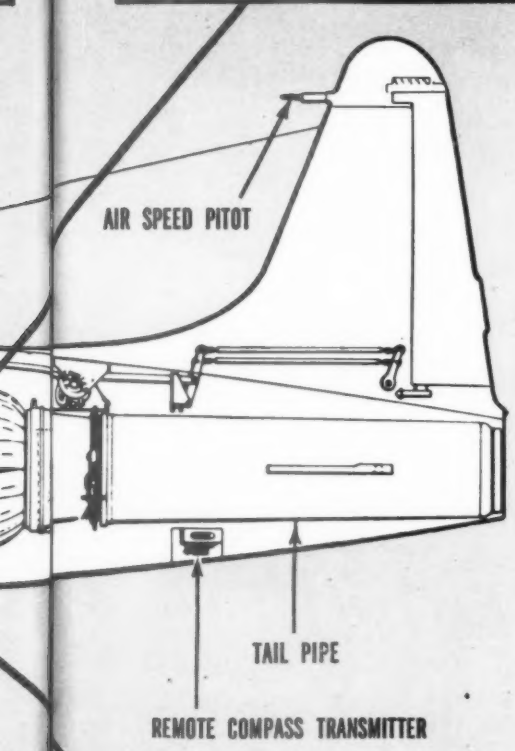
Fuselage brake flaps are needed to prevent plane from building up too much speed in rapid descent.

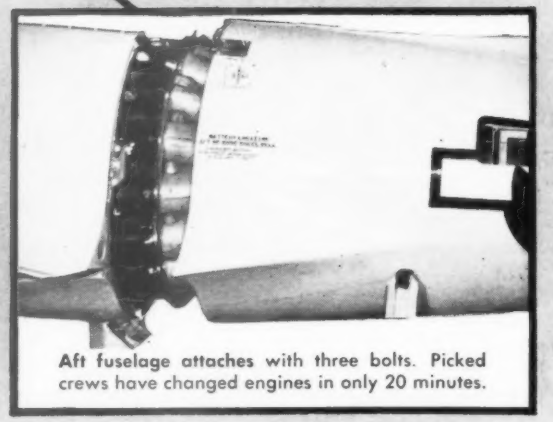
WHAT MAKES A JET PLANE TICK?

Some of the answers are shown on the left. The Lockheed F-80 was the first U.S. production jet and many of the solutions to its design problems affect all the jet models built since.



Allison 400 C-5 turbine used on later models has replaced the GE I-40 jet installed on F-80A.





Aft fuselage attaches with three bolts. Picked crews have changed engines in only 20 minutes.

easily changed. Lockheed therefore designed the aft fuselage and tail assembly to be removed as a unit. Three bolts hold the tail section in place. Control cables have quick disconnects. So does the engine tailpipe. Air Force crews have demonstrated engine changes in less than 20 minutes.

Air inlet ducts close to the wing were chosen because an inlet ram average of almost 100 per cent was obtainable from them, considerable weight was saved, better fuselage nose visibility resulted, and armament installation was considerably improved. A boundary layer bleed close to the fuselage (see facing page) solved several unexpected problems.

When the throttle was closed at high speed, a thick boundary layer developed inside the duct at the fuselage wall. Uneven flow developed in the two ducts, sometimes even reversing in one. The fluctuating flow caused an organ-pipe tone which could be heard on the ground when the plane was a mile high. A high-frequency (about two seconds) directional oscillation known as "snaking" also developed. The boundary layer bleed, developed after wind tunnel tests, by-passed the low energy air above and below the wing and improved the ram pressure. It also eliminated both duct rumble and "snaking," and cost a speed reduction of only two to three m.p.h.

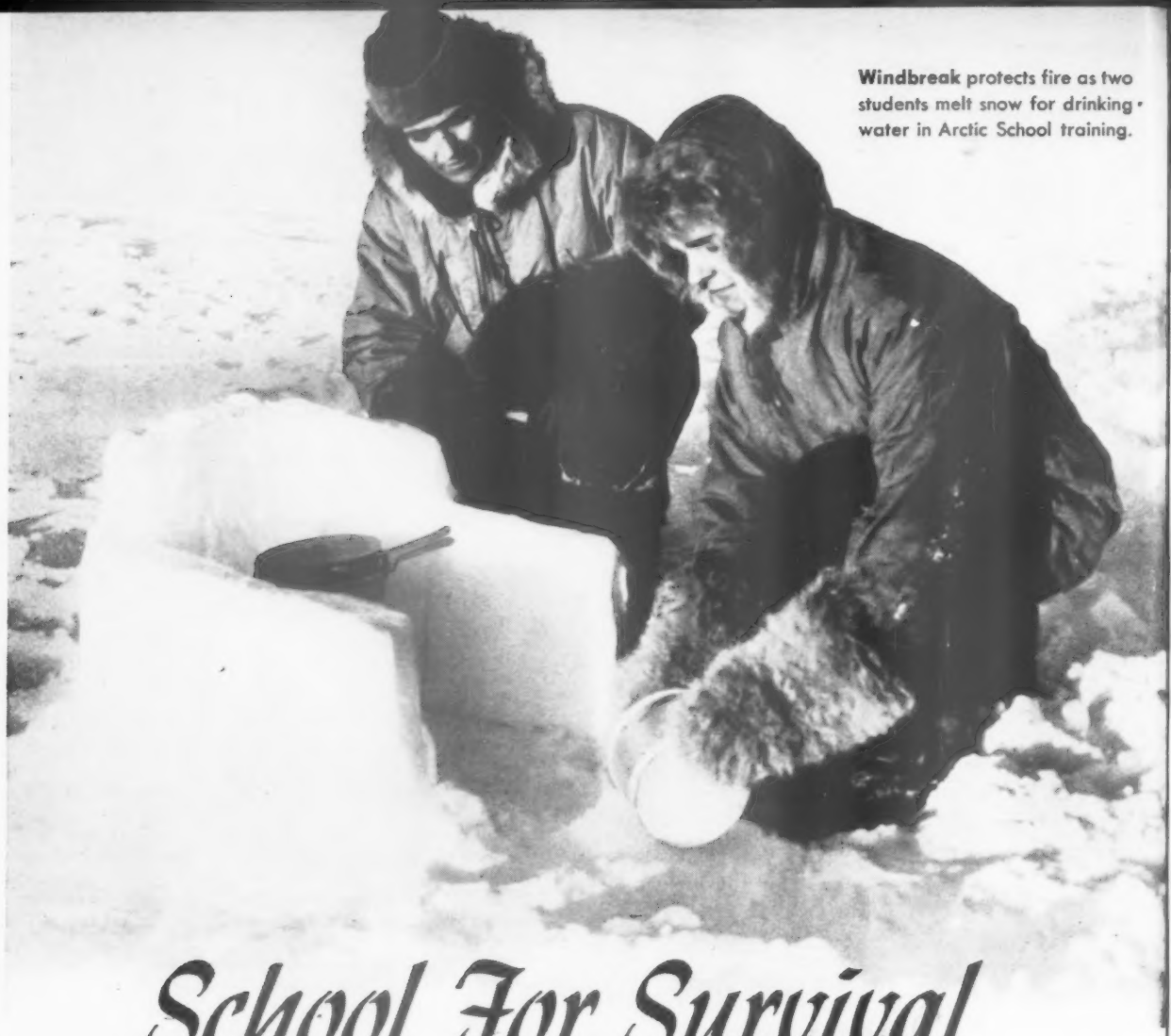
The pipe installation presented another of the typical development problems. When the nozzle diameter was decreased from 19 inches to 18½ inches, the static thrust increased 400 pounds and the jet temperature 150°. A variable tailpipe nozzle area was logically suggested as a future solution.

An emergency fuel system was developed for the I-40 engine which could be used in case of failure of the standard system. Experience has shown that a single fuel system is perhaps the most vulnerable part of the whole engine. The emergency system has saved many airplanes and has led engineers to conclude that all jet engines should be equipped with completely independent dual fuel systems—to provide safety comparable with the dual ignition systems on reciprocating engines.

One problem of early jets was that the pilot did not know how much thrust his engine was developing. A jet engine loses thrust about three times as fast as piston engines with increase in temperature. There is also a loss of thrust at altitude. It was noticed that the burner ring fuel pressure is an excellent indication of thrust regardless of outside air temperature, altitude variations and so on. The problem in using this method, however, is that each engine varies and a different ratio must be calculated for each.

Lockheed experimented with a water injection system for the I-40 engine. Little or no work had ever been done on a complete installation for water and water-alcohol injection. Substantial thrust increases were developed, approaching 30 per cent of the static thrust for flow rates of around 25 gallons of water per minute. Water injection reduced take-off distance to clear a 50-foot obstacle by 30 per cent.

The water injection experiments, however, developed very serious problems. On the F-80A, compressor pressure is used to drive the flight instruments, to pump fuel from the wing-tip tanks, and to pressurize the cabin. But with water injection on, the in- (*Continued on page* 65)



Windbreak protects fire as two students melt snow for drinking water in Arctic School training.

School For Survival

Alaskan Air Command has found a way to cheat death on the Arctic's frozen tundra.

THE WORLD'S BLEAKEST college campus is a wind-swept plain of frozen tundra and pack ice near Nome, Alaska. Here Air Force aircrews in the far north are taught to survive if they should crash in the Arctic. In winter months about 60 students per week are taught in the Alaskan Air Command's Arctic Indoctrination School headed by an Arctic veteran, Capt. Harry Strong.

From the classroom at Nome, students can look north and west and see only tundra sparsely dotted with stunted trees and drifted snow. To the south and west, the polar pack-ice drifts from the Arctic Ocean in the fall to combine with the newly-formed ice of the Bering Sea. It is a desolate scene where a man without proper clothing, equipment and know-how will die in a few hours.

Aircrews are taught as a unit. They assemble at the school and begin their week of training with one day of classroom instruction. Then the entire group moves out on the tundra. Each man wears snowshoes and carries a 50-pound pack. At intervals, the crews, each with an instructor, separate from the main group at theoretical crash sites.

Here the airplane commander takes over and delegates duties to his men. One officer is assigned as a quartermaster, responsible for the storage and issuance of rations and equipment. Another is assigned as sanitary officer. They organize the myriad details necessary for survival.

Cold is the spur to proper learning. If a student removes his glove to perform some task, his hand is quickly nipped. The men learn by experience that they must keep dry, prevent excess perspiration, waste no energy in violent exercise, and allow no part of the body to become exposed. By the end of the first night, a man who may have been swimming in the Caribbean Sea four days before begins to understand the meaning of cold. He learns something about the wonderful insulating qualities of snow, and how much better it is to burrow into it than to remain on top in a sleeping bag. He learns that a small candle inside a shelter can raise the temperature

enough to permit him to remove his outer garments. And he appreciates the value of emergency kits and rations. Tundra training fare is meager. It consists only of parachute rations — cheese, crackers, candy, gum, bouillon cubes and cigarettes.

Back at school headquarters the men discuss their experiences, expose flaws in the curriculum, and often suggest worthwhile ideas. One idea was wrapping matches with gauze and dipping the package in hot paraffin. The paraffin not only waterproofs the matches but the paraffined gauze provides an instant hot-burning tinder with which to start a fire. Another idea was the use of string and wire from the kits to bind the branches of Arctic scrub willow into a skeleton structure for a hut. Using the equivalent of parachutes, the men lace the willows together for shelters with their entrances away from the prevailing winds.

A second part of the course is devoted to survival on an ice pack. The men learn how to construct a snow cave on ice which is heavily drifted with snow, how to build an ice house or igloo, and how to fish through the ice with a barbless hook and line so as not to wet the gloves.

First job on the ice is to build shelters. The students soon learn the superiority of the saw over axe or knife for cutting snow blocks with which to build their snow house. They learn to build different types of shelters for different terrain.

In building a snow cave, a large drift is selected. One man lies prone and shovels the snow with a small trench shovel. The second man aids by removing the excess snow from behind the man digging. The inside entrance is made small to prevent loss of heat. The entrance tunnel is slightly larger. The main room is dug high enough to permit the men to sit erect. Branching out at each side is a sleeping room slightly longer than the height of each occupant. The sides of the snow caves are formed into the shape of a rough arch—an arch shape is stronger and melting snow inside the shelter runs down the walls rather than dripping (*Continued on page* 71)

School Commandant, Capt. Harry Strong, demonstrates how to construct rough ice house. Blocks of snow were bevelled with a saw.

One-man snow hole has tarpaulin flap to cover entrance. Before retiring, occupant will empty pack on floor to provide insulation.

Primitive snow huts in foreground house aircrews at school. A 10th Rescue Squadron dog team heads out on ice of Kotzebue Sound.

Mooney M-18 is new single-seater powered by a 25-h.p. liquid-cooled Crosley auto engine. It cruises at 85 m.p.h. and has 460-mile range.

MOONEY M-18

By MAX KARANT

Assistant general manager and editorial director,
Aircraft Owners and Pilots Association

FLYING CHECK PILOT

EDITOR'S NOTE

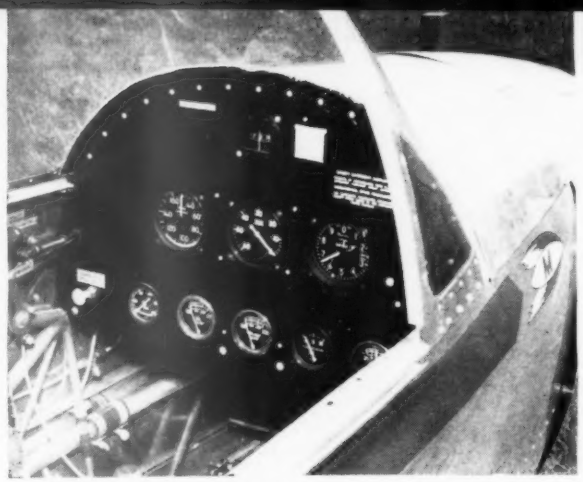
This series of articles is planned to help the pilot and prospective plane owner evaluate aircraft now on the market. Only aircraft holding a CAA Approved Type Certificate are flown. The author is not a professional test pilot. He evaluates each aircraft through the eyes of an average private pilot who flies an airplane either for business or sport.

THIS is the first time I've ever strapped an airplane to my pants and flown away. The Mooney M-18 (I'd call it the *Mite*) is so tiny that you almost "strap it on" to fly it.

This is one of the most interesting little personal planes to be produced in recent years. The M-18 has a number of unusual features: a 25-h.p. automobile engine, belt-driven propeller, almost unbelievable operational economy, and a number of others I'll mention as I go along. It is a low-wing monoplane made of wood, fabric and metal, and has a manually retracting tricycle landing gear.

The power plant is a converted Crosley auto engine. In order to use it in a certificated plane, Mooney had to get a CAA type certificate on the converted engine, as well as on the airplane. He worked out the modifications, then got the Crosley company

Wing span of M-18 is 27 feet, length 18 feet. Fixed-pitch wooden prop is driven by four wedge belts, recently designed by Goodyear. The plane's engine, called the Mooney CC46M-2, is a modified version of power plant used in miniature auto built by Crosley.



Cockpit of M-18 is not soundproofed and controls are out in open to keep cost of plane down. Plexiglas hatch slides on runners and can lock in three different positions. Gas tank is located back of pilot's head. Baggage compartment holds 20 pounds. In flight, the single-seater is extremely sensitive to controls.

to incorporate them on their production-line model. Result is that the engine now is officially known as the Mooney CC46M-2. Though Crosley delivers the modified engines to Mooney in Wichita, the Mooney people still must make a thorough examination and test of the entire power plant before it can be installed in a certificated plane.

Originally, Mooney was considering using a Waukesha or Hercules power plant. Then he saw a Crosley engine developed to run electric generators for the Navy (Crosley later adapted it for his automobile). It more nearly fitted Mooney's requirements, so he started work on the conversion. The result appears to be a reliable, rugged little engine. I found just two things wrong with the engine in the airplane I flew: at about 2,000 r.p.m. it vibrated furiously; and it had an unusually strong tendency to ice up. The latter, of course, is the most dangerous characteristic and is due, Mooney tells me, to the fact that the engine uses a very small carburetor venturi which is liable to cause it to ice up quickly and frequently. It did with me—and if I hadn't already made a few landings, which convinced me I could land this little mite in a Victory garden, I'd have been pretty scared when the engine suddenly started to drop r.p.m.'s. I quickly pulled on full carburetor heat and pushed the throttle wide open. The engine slowly began to pick up and soon was running normally.

Mechanics will be interested in these specifications for the Crosley engine used in the Mooney plane: bore, 2.5 in.; stroke, 2.25 in.; displacement, 44 cu. in.; compression ratio, 8.2 to 1; dry weight (including generator), 101 pounds.

The engine delivers its maximum 25 h.p. at 3,900 r.p.m. The fixed-pitch wood propeller, however, is driven by four Goodyear belts which turn the propeller at half the engine speed. Your first suspicion, of course, is that the belts would be the most vulnerable part of the entire mechanism. Apparently they are just the opposite. Mooney started out by using a common variety of V-belt, which held up very well, but which developed an apparently incurable slippage. During those tests, Goodyear engineers had been working on a new type of belt which eliminated all the V-belt problems, including the slippage. This new belt is called a wedge belt, and has proved so good that there have been no signs of wear, slippage or deterioration in all the rigid tests that have been made of it.

So far as the plane's powerplant efficiency and safety are concerned, there has not been a single serious problem come up with the belts. In all the tests Mooney has run, only one belt actually failed. It was one of the old V-belts and it failed during a prolonged test at 6,000 r.p.m.; the Mooney engine never turns over 4,300 r.p.m., and uses only a maximum of (*Continued on page* 73)

Take-off of Mooney M-18 often requires more than 15 seconds, but landing characteristics are excellent. The plane is not on the market at the present time, although six have been produced. These have gone to operators participating in a market-research program.

Christmas in Mexico

By BERNHARDT JENSEN

ROUND-TRIP TRANSPORTATION to Mexico City last Christmas cost $23 per person for Dr. and Mrs. Dana V. Clark of San Francisco, my wife and myself. We flew almost 2,200 miles in Mexico, border to border, in a Beech *Bonanza*, and $92 covered the cost of plane-entrance permits, landing fees, hangar charges, and gas and oil for 11 days in Mexico.

Anyone can do it with a little advance preparation. Red tape is at a minimum—for the person who knows what he's doing.

Here's the account of a FLYING Holiday that can fit almost anyone's mid-winter vacation purse.

We crossed the border at Brownsville, Tex., where the attendant who filled our tanks at Rio Grande Valley International Airport told us we could clear for Mexico any time after eight in the morning. Ralph Delgado, assistant airport manager, guided us through U. S. and Mexican customs and immigration offices. He made out papers for us, procured the *permiso de vuelo* (flight permit—fee $4.12 plus cost of two telegrams to Mexico City, or a total of just over $6). [According to the Consul General of Mexico, border-crossing procedure has been further simplified. It is now necessary only to identify yourself, buy a tourist permit and prepare a flight plan.—Ed.] Delgado also saw that each of us got a *turista* (tourist card—fee $2.10), gave us printed instructions to facilitate our return to the U. S., and even procured an authorization from Pan-American Airways to purchase gas and oil from the Compañia Mexicana de Aviacion (the Pan-American affiliate in Mexico).

Flying tourists spent $92 for transportation on 2,200-mile trip into Mexico. From left, author and wife, Dr. and Mrs. Dana Clark.

Our luggage was given a cursory exam by a friendly Mexican official, and we filed a tentative flight plan with the proviso that it might be subject to change.

After checking the weather (low clouds and haze along the coast, clear in Mexico City) we took off from Brownsville. First stop was Tampico, a straight 250-mile shot down the beach, where we were waved along without a check by customs officials. The standard fee (six peso *aterrizaje*—or landing—fee) was collected, and we bought gas by using our CMA letter.

To minimize travel over mountains, we chose to fly a two-legged course. Tuxpan, 100 miles south on the coast, was our turning point. We didn't land at Tuxpan's grass field, but found a blue hole and went up to 10,000 feet to get over the cloud layer. Seventy miles along the new course (218) brought us directly over the Tulcaningo Airport (elevation, 7,300 feet) and into clear weather. Ahead lay the valley of Mexico.

Mazatlan Airport, operated by a Pan-American affiliate in Mexico, is located four miles north of the city where the group spent New Year's Eve. They were able to obtain gas at the field but found it necessary to make prior arrangements for gas at most airports. The author says it is important to secure letters of authorization from the airlines, enabling visitors to buy from airline supplies.

At 13,000 feet, we were almost 4,000 feet above the minimum altitude for sneaking through, weather permitting. Yet Popocateptl and Ixtacihuatl, the mountain peaks a few miles to the south, drove their sharp spires nearly 5,000 feet above us. High country, this, and rugged.

Mexico City's busy airport lies just beyond the lake on this course. We picked up the tower without difficulty and received landing instructions in English. An attendant helped hangar the plane, and then took Dr. Clark to the tower where his papers were checked and another brief form completed. The six peso landing fee was the only charge. Customs officials glanced at our *turistas* and checked the seals that were attached to our bags in Brownsville. We were on our own in Mexico.

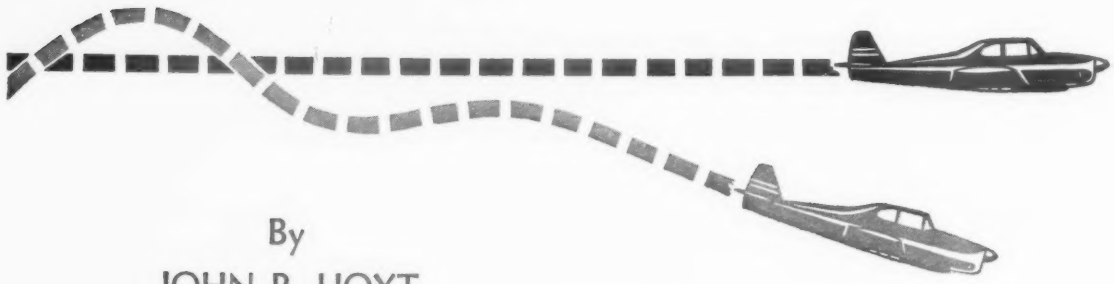
We spent the next five nights in Mexico City, visiting the town and surrounding country, celebrating Christmas with friends who had driven down from California. You can have a good time without knowing a word of Spanish. There's always someone around who can speak English—but even a few Spanish words or phrases (picked up out of a guidebook) can pay big dividends in service and cooperation. The ever-courteous Mexican will smile politely if you say "thank you." But he will beam and murmur, "Por nada, Señor" (literally, "For nothing, sir") if you say "Grácias." Even an amateurish attempt at his language is considered a token of respect for him and for his country.

For your side trips, be sure the charts show an airport, then check in Mexico City for latest information on facilities available, including gasoline. Many short hops can be planned, using Mexico City as a base. Our own itinerary (see map) was good for a cross-section view of Mexico, though there are many other interesting districts. I wanted to visit Fortín, for example, but no one else cared whether I swam in a (*Continued on page* 60)

Bullfighting is still Mexico's favorite sport. Major fights are held on Sundays in most towns from November until March.

Paricutin volcano was seen by flyers en route from Bahia Zihaultenejo to Guadalajara. Photo was taken from 13,600 feet.

Curing Those Ups and Downs



By
JOHN R. HOYT

TIPS FOR PILOTS

"For every updraft there's a downdraft" goes the old saying. The smart pilot often uses these updrafts to give him "power for free" on cross-country flights, says Author John R. Hoyt. But there are other times when it's vitally necessary to maintain a constant altitude. Here are some basic tips that can be used profitably by any lightplane pilot whether he has logged 10 hours or 10,000 hours.

LANDING his plane at the successful termination of a cross-country flight, a private pilot went to his instructor and complained that the airplane acted like a free balloon in the vicinity of a thunderstorm.

"Which," he wanted to know, "is better: to maintain a given altitude on a cross-country flight or to ignore the altimeter entirely? And if it's better to hold it, how do you do it?"

There IS a way to hold a given altitude but because so many factors enter into any decision as to how or when to do it, no simple answer has been given to the question. Many flyers have wasted time and energy trying to hold an altitude when they shouldn't have held it. Just as many other pilots have failed to hold an altitude when it was imperative to hold it.

There are times when a clever pilot can get much better performance out of his plane if he has studied the factors involved.

Take the case of the average lightplane pilot. He's flying a plane with only essential instruments (that is, no rate of turn, gyro compass, gyro horizon, or rate of climb instruments), a plane that cruises at less than 125 m.p.h. and climbs at less than 600 feet per minute. It's a bright day, with some cumulus in the sky, and he's pushing along at a good fast cruise on the initial leg of a trip. Getting the tabs adjusted, he begins to estimate groundspeed by noting the time over his first check point. When Podunk slips underneath the wing, the pilot reaches for his map, gets a mileage scale on it, twists the computer and there's the groundspeed: 105 m.p.h.

But at that point life becomes a series of ups and downs. The plane has encountered some of the turbulence which accompanies cumulus, and the altimeter shows an additional 200 feet. Airspeed has changed, the trim is off, and easing the nose down to lose altitude is accompanied by a change in r.p.m., altitude, and control pressures.

An example of a good cross-country technique was related by a pilot who flew over the mountainous area between Knoxville, Tenn., and Washington, D. C. At 7,000 feet he encountered updrafts that kept his altimeter revolving like the sweep-second hand on a pilot's watch—about 1,000 feet per minute. *This was power for free*, and the pilot realized it; instead of fighting to maintain his 7,000 feet, he chose to give the plane its "head," and soon was at 12,000 feet.

As might be expected, in a short time he hit a downdraft which unwound the altimeter about as fast as it had gone up. The pilot's correct action was not to open the throttle and climb, because in a lightplane he couldn't have climbed fast enough. Instead, he put the nose down, turned away from the downdraft and found stable air. Usually, such convection currents are confined to rather small areas and a few minutes will take the pilot well out of danger.

This pilot found stable air at 9,000 feet, leaving him a surplus, or *profit*, of 2,000 feet, which he received free of charge from nature's power supply because he used his head.

This is the first principle of altitude control on cross-country flights, although convection currents or updrafts as violent as the one above are not encountered very frequently. There are other principles, too, and it is vitally necessary to hold one's altitude at times—such as when flying on Instrument Flight Rules (IFR), when crossing airways, when flying over congested areas at minimum legal altitude, or even when taking a flight test on pylon eights. Under these or similar conditions it is necessary that a given altitude be held and there are a number of ways to do it.

The first problem is to classify the flight: Constant Altitude or Variable Altitude. The following factors must be considered:

CONSTANT ALTITUDE FOR: Instrument Flight Rules (IFR), Crossing Airways, Flying at minimum altitude above ground, Minimum ceiling ahead, Traffic patterns, Flight tests; VARIABLE ALTITUDE FOR: Visual Flight Rules (VFR), Weather CAVU, Distance from destination over 10 miles, Terrain safe, Type of plane: stable.

For example, under Visual Flight Rules (VFR) in a stable plane, with sufficient margin of altitude above the ground, and with convection currents, the pilot decides to allow himself a variable altitude. He takes off, trims his plane for cruising, and gives the plane its head in updrafts. He avoids flying along valleys or to leeward of ranges where downdrafts pre- (*Continued on page* 63)

Bail-Out at Midnight

Author spent five years in the Navy but his adventures were not routine.

By JOHN G. PRESSLER JR.

Lieutenant, U.S. Naval Reserve

'For gallant action' this Navy pilot was awarded a fur-lined chamber pot.

IT WASN'T possible. It simply wasn't being done. The very idea of floating down in a parachute in the darkness of the night near Washington, D. C., with a war going on. Especially a naval pilot in a military plane on a mission from his carrier to D. C. with a ranking intelligence officer in the rear seat. But it was so. My passenger was Lieut. Comdr. Thomas Boucher from the spanking new carrier, the U.S.S. *Bon Homme Richard.*

"Poor Richard" was berthed at Norfolk, Va., preparatory to making her initial shakedown cruise to Trinidad. I was delegated to fly the commander to Washington one afternoon so that he could conduct some official business there the next day. It is a short distance by air. (The fact that we had planned an interesting evening the same night has no bearing on the case.)

We left the field in an SNJ as dusk was approaching and were so pressed for time that we hurried through all the preliminary procedures quickly. In my haste to leave, I did not thoroughly check the radio nor did I succeed in contacting the tower as we circled and left. I thought the frequency was off a little but did not bother much about it. Old man Boucher was getting comfortably seated in the rear—if you can be comfortable with a parachute pack and heavy Navy overcoat in a little bucket seat. He is six feet plus and had to hunch over when he slid the canopy over his head.

The sun had set and the sky was getting dark as we cruised along. We each had a map and scanned the ground closely identifying landmarks. The trip was so short I confidently pushed on with an approximated compass heading. I planned to turn on the radio when we got near so as to fly in on the radio beam. It was simple.

But when I tried the radio it didn't work. Hence no beam. We overshot D.C. and turned back. By now it was really dark and we could see lights below. Boucher was starting to get a little uneasy back there and every time I turned around to give him a look of confidence I couldn't help grinning. Without flying togs or a headset he looked as out of place as Man Mountain Dean jammed into a kiddy-car.

I was becoming somewhat concerned myself because an overcast was forming at 4,000 feet and it was getting

difficult to keep the ground in sight. Boucher's uneasiness was obvious now as he began a series of finger movements from the map to various points below. He was trying to shout above the wind and the more concerned he became, the more he gestured. I couldn't blame him one bit.

Normally, at this time, a pilot would work out what is referred to as a "square search" pattern for lost plane procedure. This involves some computing on the plotting board resulting in a flight pattern that is a constantly enlarging square, with each leg on the sides of the square becoming longer. Somewhere along the line you should spot your destination as the square becomes larger and covers more ground. But we didn't have a plotting board along as it is not generally used for a flight of this nature. I didn't see how we could be far off anyway (famous last words).

We flew on, blindly.

All controls had been set for maximum endurance for some time. Back and forth we went. Our gas was now down to five minutes flying time. For the life of me I could not imagine having to bail out under such circumstances. The only time people hit the silk is when their plane is on fire or they are lost on a long hazardous mission. *Something* terrible, anyway.

I dropped the flaps and throttled back some more to lose speed. When I yelled at Boucher to bail out, he looked nonplussed, but methodically removed his officer's cap and placed it on the deck of the cockpit, slid the hatch back and tugged at his 'chute straps to see if they were snug. He started to climb up on his seat, looked around a bit and hung on as the tail started to bob up and down with his movements.

He was cool, all right, and after a few seconds dove out head first in the approved manner. Bro-ther, when he left that ship the tail jumped up as though tons had been dropped out. I later learned that he landed in the top of a dead tree and broke off every branch on the way down.

I flew straight ahead for a few minutes checking my own straps, disconnecting my headset, and thinking of what I had to do. Then I rolled the plane over on her back, pulled the safety belt loose and dropped out in recognized fighter-plane style.

When I pulled the cord or "D" ring of the 'chute, it slipped out like pulling a string through soft butter. I thought something was surely wrong and was almost surprised when I was jerked sharply and felt myself floating down. The snap of the 'chute opening had caused one of my new shoes to fly off into space and I mildly cursed the loss. I was completely alone in an eerie, quiet, black void.

Then something happened that still seems hard to believe. The ship had gone out of sight, but as I began to prepare for the eventual ground contact, I spotted her light coming closer. The darn thing came straight on with wing lights glowing . . . closer and closer until I began to wonder what in hell I was doing in *this* predicament. The numbers on her side became visible and I could see the cockpit lights glowing as she headed for me. I felt as helpless as a new-born fawn watching a hungry wildcat.

The good Lord preserves Dilberts because the Old Lady swished by like a ghost. I heaved a relieved sigh as the plane continued on out of sight—until it turned around again and came back to *do the same thing.*

This time the plane came so close I pulled for all I was worth on the shroud lines to spill some of the air from the canopy and slip sideways out of the way. What a stupid way to depart from this old earth I thought. Again she missed and went out of sight for the last time. I thought I heard the sputter of the engine as it conked out, but I'm not sure.

A few minutes later I landed in snow. I crawled out of the 'chute and looked around. My shoeless foot was getting cold so I started across the field to the side that looked most likely to have a road adjoining it. Sure enough, an old dirt road ran by. I remembered my Boy Scout training and tried the old "Run 50 paces; Walk 50 paces" routine. But my foot was so cold it was more like "Run 50 paces; rub your foot 50 times." If ever I felt mentally sick, this was the time, plane and 'chute gone, passenger God knows where, my new shoes worthless, a cold sore foot, hungry, worried about the skipper . . . oh, my achin' head.

A lone farmhouse loomed up ahead after about four miles of slopping around in the mud and snow. As I approached the house a woman came out very cautiously as though I were Jack, the Ripper, himself. When I explained the situation, she told me she had heard a plane flying dangerously low and said it had "landed" across the road a bit. She was very excited and directed me to the ship.

There is a very definite Navy procedure in event of a plane accident while on a cross-country trip. I racked my brain thinking of cross-country (*Continued on page 70*)

Stirring climax to the saga of a midnight bail-out came several days later when Pressler's passenger, Lieut. Comdr. Thomas Boucher (right) presented him with a fur-lined chamber pot. 'Such is the stuff heroes are made of,' mused Pressler as he accepted the award.

The Mighty Force of KINETIKOS

WHAT IS KINETIC ENERGY?

The Greeks called it KINETIKOS (kinetikos). Kinetic energy is the energy stored in all moving objects. It is the energy in a bullet, a moving train, an airplane in flight. When the mighty forces of kinetic energy are uncontrolled, the result can be disaster. When speed is doubled, kinetic energy is quadrupled. Every pilot ought to know and understand these important facts.

THE ENERGY packed into a moving airplane is something that every pilot ought to pause and give thought to. Too many of them have been ignoring it. But as lightplanes get sleeker and faster, this *kinetic* energy becomes more and more important to understand.

Airplanes are the fastest vehicles yet invented. At the same time they are among the most fragile. Because they may be destroyed by kinetic energy, knowledge of its power and meaning ought to be drilled into every pilot from the time he goes on his first flight. Even though the CAA and some aircraft manufacturers, notably Beech, have campaigned for years to teach pilots about the meaning of energy growing out of motion, too little attention has been paid to it.

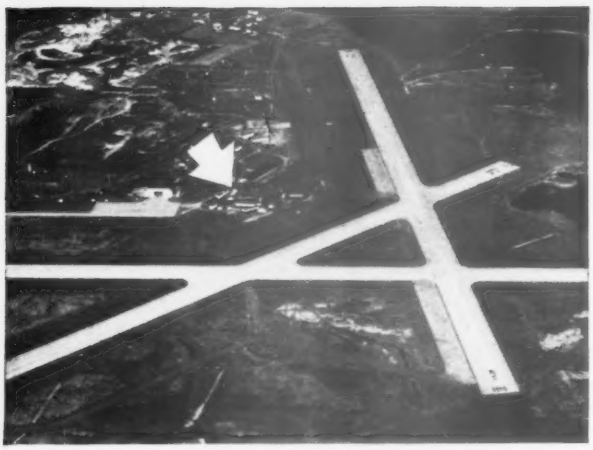
Kinetic energy is why planes still shed wings in high-speed pullouts, why a cloud of debris falling out of a thunderhead indicates what was once an airplane and why eyewitnesses occasionally report erroneously that "the plane exploded in mid-air." They did not explode; they did not hit anything. They were simply subjected to stresses far in excess of their design speeds. Their pilots should have known better.

Most lightplanes are designed for a limit load of 3.8. This means that a stress of 3.8 times the normal stress existing in any part of the structure when the plane is flying in smooth air may be imposed upon the plane without appreciable permanent structural deformation.

In addition to the 3.8 limit there exists a safety factor of 1.5. That is the point failure is more or less expected to occur. By multiplying the 3.8 limit load times the 1.5 factor of safety, you obtain an ultimate load factor of 5.7. This means that failure of the airplane would occur at a stress 5.7 times the normal stress encountered in smooth air.

These are the minimum CAA requirements. Most lightplanes, naturally, are stronger. Generally speaking, the larger the airplane, the lower the ultimate load factor. Transport planes usually have an ultimate load factor of 5.0 or less. Trainers designed for aerobatics have 8.0 or better. Fighters may go as high as 10.0 or 12.0.

In lightplanes, the 3.8 limit load factor, on which the 1.5 factor of safety is superimposed, has been determined by arbitrary assumptions as to the maneuvering loads which will be put on the airplane. (*Continued on page* 67)



Air Holiday, Inc., (arrow) is located on Trumbull Airport near Groton, Conn. The flyers' resort was a Navy base in World War II.

Cocktail lounge is one of two converted from old Navy officers' quarters. Special parties and dances are held almost every week.

Groton Air Resort

UP IN CONNECTICUT, where the Thames River flows into Long Island Sound, Air Holiday, Inc., offers flyers a one-package resort vacation—including topnotch aircraft service, an inn with excellent rooms and delicious meals, and nearby boating, golf, tennis, fishing, swimming and just plain relaxation.

The resort, located at Trumbull Airport three miles from Groton, Conn., is an ex-Navy base converted into a plush retreat for pilots who want all their vacation activities within hailing distance of a landing strip.

An old Navy officers' quarters has been turned into a 30-room hotel with a large dining room and cocktail lounge.

The field (CAA class four rating) has three concrete runways—one 5,000 feet, two 4,500 feet. Facilities for water landings and night field landings are available.

Overnight tie-down fee for small planes is 50 cents, hangar storage $1.50. For hangaring a four-place job, it's $2. Room rates are from $4 single to $7 double; and breakfasts cost about $1, lunches from $1 to $2, dinners $1.60 to $3.50. END

PHOTOGRAPHS BY WALTER STEINHARD

THE BRADTS VISIT GROTON

Ercoupe pilot Nelson A. Bradt and wife of Weston, Mass., arrive for an Air Holiday weekend. They are met by jeep, directed to a parking area. Their double room cost them $6, tiedown 50 cents.

Lobster specialty is served by Chef John Hall in the pine-paneled dining room (capacity 280 persons). The majority of visitors are flyers on weekend hops, but some guests spend several weeks.

Giant hangar at Air Holiday is a hold-over from World War II days when planes as large as B-17s were housed in it. Today, Air Holiday is able to accommodate most of its transient traffic in the one hangar. Fee for small planes is $1.50, for the larger four-placers $2.

Air Holiday rooms are newly-furnished. The Bradts retired early, after a day spent sightseeing at historic Fort Griswold and nearby New London Naval Base. Air Holiday furnished transportation.

Ready to leave, the Bradts checked costs for the weekend, found they amounted to less than $30 for housing, food, fees, and recreation. Lineboy taxied their plane over to administration building.

Beech Bonanza gives a Michigan ad agency cheaper, faster transportation than auto, train or airline.

Author Dale Rooks (left) flew to west coast on typical business trip with advertising executive Oliver A. Wallace and Wallace's pilot-son, Dan (right). Operating expense for trip was $101.65.

A BUSINESS PILOT'S REPORT

A Business Plane Pays Off

By DALE ROOKS

"A PRIVATE plane save money? Baloney!" That was exactly my reaction to the confident assertion of the man in the co-pilot's seat ahead of me. He was Oliver A. Wallace, president of a leading Michigan advertising agency, Wallace-Lindeman, Inc., of Grand Rapids.

We had taken off from Grand Rapids a half hour before. Between us and Los Angeles were a lot of miles, a range of high mountains (about which I was privately worried) and a good half-dozen business appointments in as many cities, so closely scheduled that I believed it impossible to make them.

My personal reasons, as an advertising photographer, for being aboard the trim Beech *Bonanza* that morning were two-fold: a picture story assignment in Hollywood for a national magazine and a short series of advertising photographs for an aircraft corporation. These were to be made in several cities along our route.

Mr. Wallace also was headed for California for two reasons: a personal survey of base airplane operators across the country for Continental Motors' "Start Flying Now" campaign and a study of department store annual sales in other cities for his account, Wurzburg's of Grand Rapids. This latter assignment called for interviews with publicity and advertising executives in Los Angeles and San Francisco. Our combined operations were to be completed in a long week—nine days, to be exact.

"As advertising agency for Continental Motors Corporation," said Mr. Wallace, "we felt that we should own and operate an airplane to really get a feel of the private and executive aircraft business. We bought an Aeronca *Champion* right after the war. It was one of the first available *Champions*, but we switched later to the faster Cessna 140."

They then purchased the roomier, faster, four-passenger *Bonañza* in which we were flying at 160 m.p.h. toward St. Louis. It was not until this investment in a four-passenger plane that aviation really began to "pay off" for the advertising agency. Clients and company executives could be flown to various markets in a minimum of time. Trips which formerly took at least 24 hours were made in the morning, with appointments back home in the late afternoon. This cut hotel bills, meals and traveling expenses of the firm by a third.

For instance, on this trip, the round-trip fare alone by commercial air lines from Grand Rapids to Los Angeles would have been $874.62 for the three of us. Our operating expenses were only $101.65, a saving of $772.97, to say nothing of the extra side trips and stops we made.

Although purchased primarily for their Continental Motors account, the *Bonanza* proved a money-saver in many divisions of the agency. For his large department store account, Mr. Wallace was required to keep close personal check of department store activities in other cities.

In July, for example, the agency was called upon to check a model circus playing in Peoria, Ill. To reach Peoria by auto would have been an all-day drive each way. By railroad it would have meant a 16-hour train trip at a cost for two people of over $62. By *Bonanza*, the entire trip was made in less than seven hours: 3 hr. 53 min. round trip flying time. Operating cost of the flight was just over $13!

In the farm advertising field, the *Bonanza* proved its name as well. The agency services the John Bean Company of Lansing, Mich., and a Wallace-Lindeman representative was sent to farmers' meetings in Oklahoma, Indiana, Ohio, Illinois and Iowa. "By flying down to these meetings," Wallace continued, "we not only saved

our company executives' time but also impressed the farmers attending with our modern approach. More farmers are interested in planes than any other occupational group we have contacted.

"In the five months we have flown the *Bonanza*, we have made business trips to Dallas, Peoria, Indianapolis, Nashville, Pittsburgh, Sault Ste. Marie, Green Bay, Milwaukee, Cleveland, Ft. Wayne, St. Louis, and to Detroit, Chicago, and Muskegon more times than we can remember.

"One time," he recalled, "we landed our *Bonanza* in a pasture right next to the harvest fields in which a grange meeting was being held. That created a sensation at this Ohio gathering and our contacts were really worthwhile!"

By now we had passed over Indiana and most of Illinois, and we were practically over St. Louis. Dan Wallace, 19-year-old son of the agency president—and his father's pilot—nosed the plane down through the rapidly thickening fog. I made short work of a couple of photographs while Mr. Wallace talked to several base operators at St. Louis.

The fog over St. Louis lasted just long enough for us to accomplish our business and get a good meal under our belts. We had flown the 370 miles from Grand Rapids in 2 hr. 20 min. We had left our home base in the early morning and had arrived in St. Louis just in time for breakfast. Had we desired, we could have had a full business day in St. Louis and been home by nightfall. But we headed the ship southwest for our next business appointment in Tulsa, Oklahoma—a late luncheon date at the airport.

Enroute, Oliver Wallace continued the conversation. "A number of new accounts came to us precisely because we had this *Bonanza*. Sales development in an area always requires accurate, last-minute information about other sales promotions in the region. Our plane was the ideal answer. So," he continued, patting the dashboard of the *Bonanza*, "we've got Bessie here to thank for some nice new business. Just last week we made jobber and store contacts in Toledo and Ft. Wayne in three working days, saving the two additional days that would have been needed to drive down there."

I asked a question: "Let's get down to figures. Just how much does the *Bonanza* cost you?"

"Fair question," he answered. "I knew you'd ask it sooner or later. Actually, it doesn't cost much more than it does to operate and maintain the company's automobile. Although I haven't exact figures with me (Mr. Wallace later verified these costs at his office) if you take all costs —insurance, maintenance, hangar rent, gasoline, oil, check-ups, and repairs—we've found that when we fly the plane at least 300 hours per year, the cost approximates six cents per mile."

I must have looked surprised. "All right," Wallace said, "keep a record of the plane's expenses on this trip and you'll see for yourself." I became (*Continued on page* 56)

Five Months of Business Flying

Miles flown	25,564
Hours flown	166
Average speed (m.p.h.)	155
Gal. gasoline per hour	10
Average oil consumption	1 qt. each 4-5 hrs.

Cost	
Depreciation	$ 661.50
Gasoline	541.70
Oil	32.45
Hangar fees, rental	186.00
Maintenance	80.50
Insurance	149.75
Total	$1,651.90

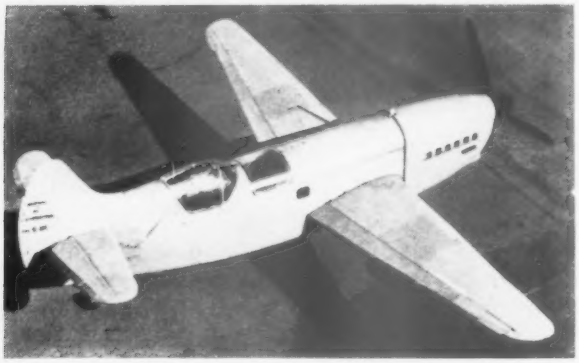
Cost per plane mile 6.5 cents. Cost per passenger mile at average of three passengers 2.2 cents. Capacity passenger load (four persons) would make cost per passenger miles 1.8 cents.

In Los Angeles, Wallace party settled down to three days of business engagements. Flying time for the 5,499-mile trip was only 35 hr. 53 min.

HAVE YOU SEEN?

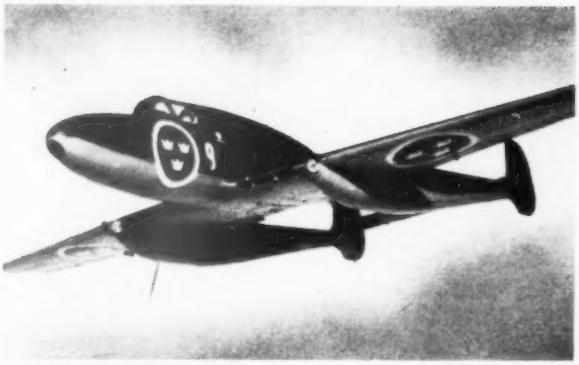
Argentine night fighter is twin-engined Namcu, designed and built at military aircraft factory at Cordoba. Plane is all-metal; wing span is 49 ft. 2 in., maximum speed 440 m.p.h. It is powered by two Rolls Royce liquid-cooled engines.

Bristol Brabazon, huge British transport, has span of 230 feet and is designed to carry 224 passengers at 250 m.p.h. Eight Bristol Centaurus engines will drive four propellers through gear boxes. The plane is intended for non-stop London-New York flights.

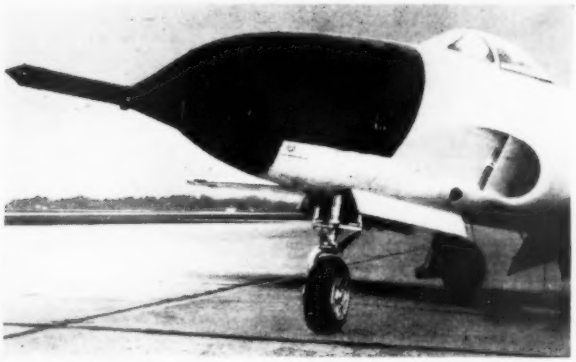


French Arsenal O-101 is a test plane with special attachments on which experimental wings and wing fittings can be flight tested.

Vickers Viscount is first civil transport powered exclusively with turbo-prop engines. It can carry 32 passengers at 300 m.p.h.



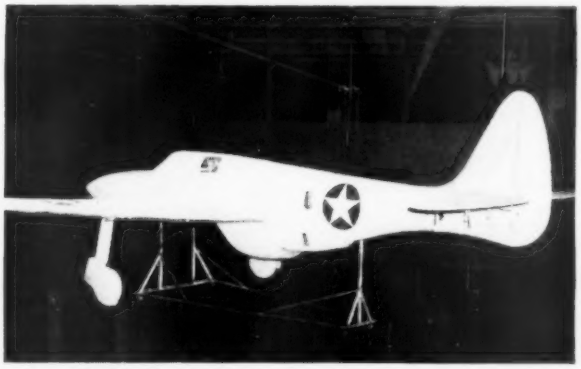
Swedish Saab-21A single-seat pusher fighter is powered by 1,475 h.p. Daimler-Benz engine. Top speed: 398 m.p.h. Cruise: 324 m.p.h.



Rocket launcher for high-speed AF planes is mounted on nose of F-80. It is first automatic rocket installation on a jet plane.

Sweptback wings give a futuristic look to Swedish Saab Safir. The extremely thin wing (intended for Sweden's latest jet fighter, Saab-29) was extensively tested on this Safir lightplane, designated the Saab-201. The sweptback version of the 145-h.p. Safir is experimental.

Zyg's-Zag II, a Curtiss-built CW-22A, is owned by Larry Zygmunt of Detroit. The 1939 model was the forerunner of the famed SNCs.



Republic XF-69, designed during past war, was not put into production. Estimated top speed on 2,350 h.p. engine was 450 m.p.h.

I Learned About Flying From That! NO. 109

When this Aeronca got on the loose without a pilot, the author had trouble corralling it.

Author and pretty bride spent hectic minutes chasing a runaway Champion in Florida.

By DANIEL G. FORBES

Lieutenant, U.S. Naval Reserve

THIS is the saga of a series of "Gizmos" with a final sequence that out-Keystones the Keystone comedies of the early twenties. It was unfortunate that camera and celluloid weren't available to record the fiasco at Showalter Airpark in Orlando, Fla., on a sunny December day. The film would serve as a monumental example of 100 per cent pilot error on the part of a 2,000-hour Naval aviator.

The story starts with a honeymoon—my wife Frances and I on a wedding trip, motoring through Florida. Part of our routine consisted of hiring light aircraft about every third day—hitting the blue, and viewing the surrounding countryside from the air. In the enthusiasm over the project, I had neglected to give Frances a cockpit checkout and failed to show her how the instruments and controls worked. If she had known how to turn the master switch from "ON" to "OFF" position, the succeeding events would not have taken place and this pilot would not have been the victim of embarrassment and physical pain.

We had been flying for a few hours over the Orlando-Kissimmee area in a rented Aeronca *Champion*. We were hungry and decided to land at Showalters for a quick snack. After lunch we strolled out to the line and observed light fog rolling in from the lakes, threatening clouds and the possibility of a rain squall. We wanted to return to our base before the weather closed in. I had been an aviation cadet in Sanford and Jacksonville, and should have remembered that Florida rainstorms generally last about five minutes before petering out and almost invariably are followed by clear skies.

We looked around for a mechanic. None was in the immediate vicinity, so I decided to spin the propeller while Frances sat in the rear seat. As soon as the engine started up, I planned to jump into the front seat. After turning the plane into the wind, and setting the throttle at idling, I started to spin, anticipating no trouble.

As soon as the engine caught, the aircraft proceeded to creep forward—very slowly. All that had to be done at this point was to turn the Master Switch "OFF," but the lovely bride had not been instructed in this procedure. As soon as the plane started forward, Frances' natural reaction was to get out of the "infernal" machine. My objective was the cockpit. We met at the door—both with an entirely different idea—one to get in, the other to get out.

In that split second of confusion and scramble, Frances' knee hit the throttle, thrusting it forward—and all hell broke loose. The plane didn't ease forward—it literally bucked. The wing strut clipped me in the ribs. I went down for a short count, then realized that my wife was sitting behind 65 horses of uncontrolled power, staggered to my feet and took off after the runaway Aeronca. Frances did not freeze up, but (*Continued on page* 69)

HOW TO PUT YOUR HOME OFFICE

Out where Sales are made

1. Want to make sure you don't lose the "feel" of the field? Want to let the men "on the firing line" know you're out there with them? Then investigate the new Cessna 195 and 190! They make it easy for home office men to visit and trouble-shoot anywhere in the country!

2. For these are not light planes but 4-5 place *airliners* . . . with luxurious interiors, airline-type engines, Hamilton Standard Constant Speed Propellers . . . every comfort and safety feature. They cruise at over 160 m. p. h.—have a range of 700 miles—get you there in a hurry!

3. Because they're just the right size for the average executive group and so economical to operate—these planes permit more efficient use of key personnel. In the coming battle for business can *you* afford to be without the speed and prestige *airpower* offers your company?

The 195 is equipped with a 300 H. P. Jacobs Engine. The 190 is the same but equipped with a 240 H. P. Continental Engine. Both are all-metal . . . have electrically operated full-range wing flaps, Cessna's Patented Safety Landing Gear and famous cantilever wing design. See your Cessna dealer.

Cessna
190 and 195

ALSO SEE THE CESSNA 140 and 120! 2-place, all-metal-structure, cross-country planes. Top speed—over 120 m. p. h. Range: Over 450 miles. Ideal for flying salesmen.

MAIL THIS COUPON NOW . . .

Cessna Aircraft Co., Dept. F, Wichita, Kansas

Please send free literature giving complete description of the Cessna 190, 195 ☐ Cessna 120, 140 ☐
Additional material for model builders ☐

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AOPA NEWS

Aircraft Owners and Pilots Association is a service organization for the private pilot or aircraft owner. AOPA's full time staff is devoted to helping the individual pilot. Its aim is: "To make flying more useful, less expensive, safer and more fun."

Headquarters are: 15th and New York Aves., Washington 5, D. C. Members also receive a special AOPA edition of FLYING, newsletters and confidential aviation data. Opinions expressed in this column are not necessarily those of FLYING MAGAZINE.

LANDING FEES AGAIN

Two more airports that charge landing fees have been reported to AOPA.

One has unusually high fees: $5 for a *Bonanza*, for example. The field is Saratoga Airport, Ballston Spa, N. Y., and its landing fees run as high as $15 for a large plane. Several members reported this field to AOPA. The airport manager told AOPA the field could get revenue only from such charges, that nearby communities contributed nothing to its upkeep. This airport serves the Saratoga race track.

Second field is at Put-in-Bay, O., and also is reported to be a private field. Operator is Milton Hersberger, who runs a shuttle service from the island to the Ohio mainland. Hersberger charges a flat fee of $1 for private planes—but makes it clear he doesn't want them to use his field. He would prefer they land at Peninsular Airport on the mainland, then use his shuttle service to the island. Further details in THE PILOT.

CHART DATES

Latest list of current aeronautical charts, formerly run in each issue of FLYING, will appear in THE PILOT, effective with the next issue. Arrangements have been completed with the Coast and Geodetic Survey to supply AOPA with the information as quickly as it is available.

CHICAGO UNIT

An active air-marking program undertaken by the Fort Dearborn Unit of AOPA, Chicago, has been getting nationwide publicity. The unit, under the direction of Wesley Cratty, chairman, has made arrangements to install a number of much needed air markers in the Chicago area. The Martin-Senour Paint Co. of Chicago is donating the paint, and members of the Fort Dearborn Unit plan to do some of the actual painting themselves. One of the first new markers is slated for the roof of the giant Merchandise Mart.

LIST OF RANGES

AOPA has completed arrangements to obtain a limited supply of lists of radio facility identifiers (recently changed from two-letter identifiers to three), and will make them available to members.

SUPERMEN?

AOPA has just received a report from British government sources which summarizes an interesting experiment conducted by the Royal Air Force. RAF medical men set up a careful watch on more than 100 "sub-standard" men who were taken in as pilots due to the manpower shortage. A similar group of "standard" RAF flyers was set up so that comparisons could be made at all stages of their progress.

An important conclusion was that there appears to be little difference between the success as airmen of the sub-standard specimens over the standard ones. Further details in THE PILOT.

AOPA mail room at Washington National Headquarters sends out more than 117,000 pieces of mail each month. When this photo was taken, 20,000 pieces of mail were handled.

WILSON RESIGNS

Lloyd R. Wilson, Jr., assistant general manager of AOPA, has resigned. He has not yet announced his plans for the future.

NAVIGATION AIDS

First meeting of the Air Navigation (Airnav) Panel of the Air Coordinating Committee has been held in Washington. This is the Government body that will control allocation and priority of all U. S. air-navigation aids (radio ranges, beacons, ILS, GCA, etc.). Air Force, Navy and civilian interests are represented, with J. B. Hartranft, Jr., AOPA general manager, representing private flyers. Air Force, Navy and CAA have submitted their priority lists for coordination into a master working list. Mr. Hartranft will indicate priorities on equipment he feels will be of greatest aid to private flying.

AIRPORT AWARDS

This year's committee that will handle the Haire Airport Trophy awards includes Mr. Hartranft. AOPA already has supplied the committee with the latest listing of above-average and superior AOPA-rated airports.

AOPA IN PARIS

The annual international conference of the Federation Aeronautique Internationale (FAI) was held recently in Paris. One of the seven delegates from the United States was Alfred L. Wolf, prominent Philadelphia attorney, sportsman pilot, and AOPA's general counsel.

The FAI is the world governing body for all sport flying.

The conference was attended by delegates from 23 nations. There were five days of meetings, during which time Mr. Wolf worked in behalf of private flyers in the United States. His activities are described in his own report of the affair, which appears in detail in THE AOPA PILOT.

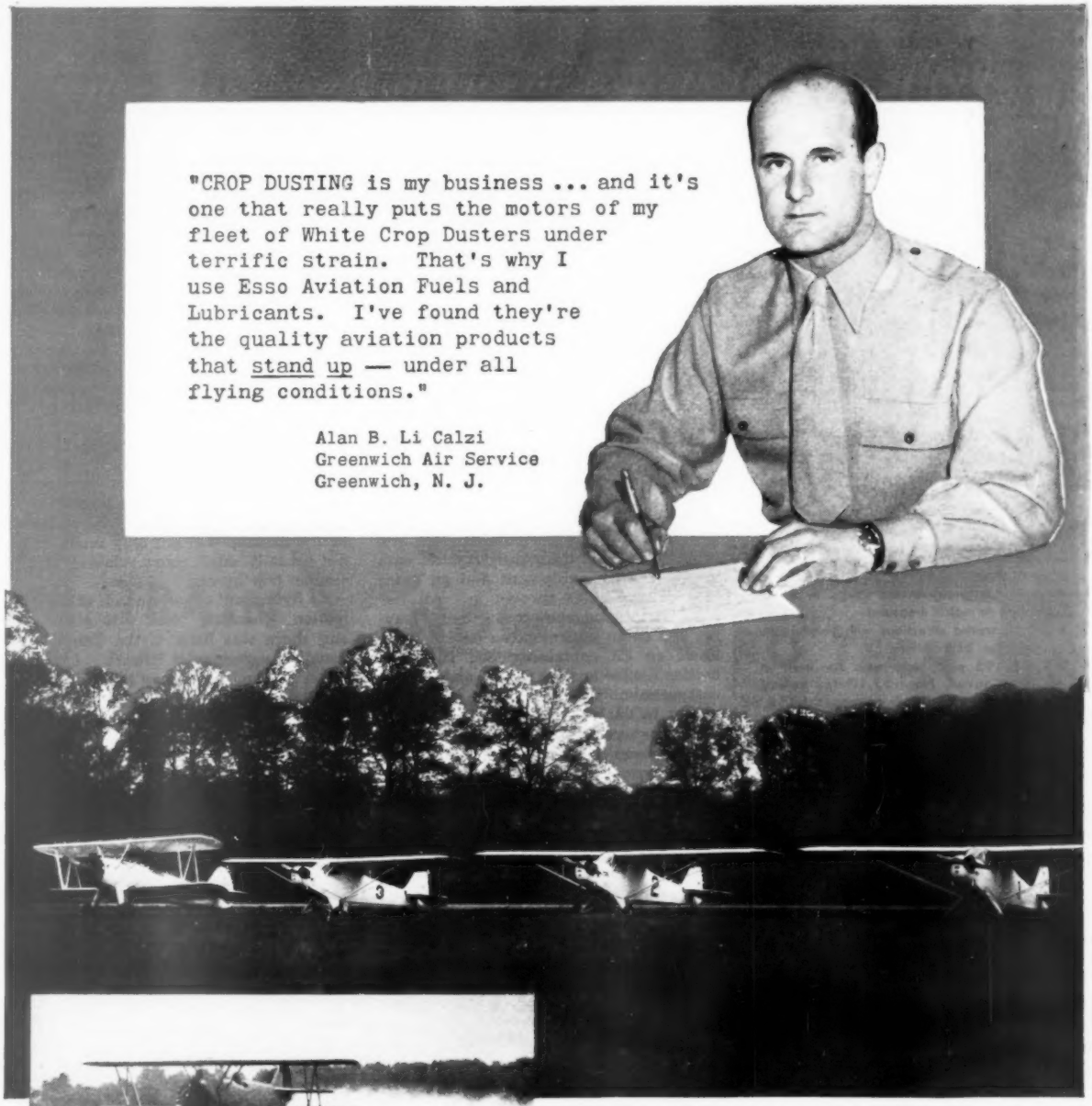
During the conference, William Enyart, former head of the National Aeronautics Association, was named president of FAI. It also was voted to have the 1949 conference at Cleveland in August. Russia dissented.

AIR TAXIS

Members of the National Aviation Trades Association (NATA) have formed a nation-wide air taxi service. NATA members are fixed-base operators. A small directory listing NATA air taxi services is now available. AOPA members may get a copy by writing national headquarters at Washington.

"CROP DUSTING is my business ... and it's one that really puts the motors of my fleet of White Crop Dusters under terrific strain. That's why I use Esso Aviation Fuels and Lubricants. I've found they're the quality aviation products that stand up — under all flying conditions."

Alan B. Li Calzi
Greenwich Air Service
Greenwich, N. J.



(Above) Part of Alan Li Calzi's fleet of "White Crop Dusters." **(Left)** "'Hedge hopping' in crop dusting calls for what you get with Esso–dependable products," says Mr. Li Calzi.

A STAFF of over 2000 research scientists and technicians, working in America's largest petroleum laboratories, are constantly searching out new ways to improve the famous high quality of Esso Aviation Products... the fuels and lubricants flyers can depend on.

YOU CAN DEPEND ON

Esso

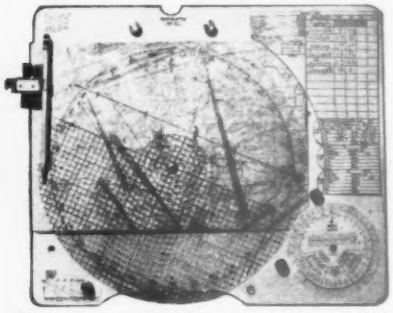
AVIATION PRODUCTS

SOLD IN THE 25 STATES INDICATED

ENJOY THAT TRIP!

Show your friends that safe, accurate navigation can be fun when simplified with

MAPIGATOR



(⅛ actual size—weight 27 oz.—rests on lap or at side)

1→ the ONLY combined map-holder, plotter, computer, and flight log—serves as a baby chart table for small planes.

2→ just slip in your regular maps—no special map rolls needed.

3→ measure mileage and courses with a simple turn of the big disc.

4→ set wind arrow to read headings, drift, groundspeed at a glance.

5→ compute fuel weights and range in U. S., Canadian or metric measures.

6→ clear, illustrated directions with helpful tips bypass hours of training.

7→ only **$17.95** postpaid—pays for itself in gas, time saved. No risk, 10-day refund guaranteed. More details on request.

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Dept. F12, 136 West 52nd St., N. Y. 19, N. Y.
Please send me Mapigator, complete with simple, illustrated instructions. I understand that if I am not completely satisfied I can return it within 10 days and my money will be cheerfully refunded.
NAME.....
ADDRESS.....
☐ I enclose check or money order. ☐ Please send C.O.D. (U.S. delivery only)

AIR FORCE A-6 STYLE **SHEEPLINED FLIGHT BOOTS**

100% Water Proof

12.95 POST PAID IN U.S.A.

Wear With or Without Shoes!

● Heavy Duty ZIPPER Closure

NEW! Magnificient! Luxuriously lined thruout (including tongue) with warm, fleecy Sheepskin. Water-repellent Brown Aqualac-finish leather uppers, soft and pliable, with waterproof Black rubber lowers. Non-skid tread heels, soles. Easy-sliding Zipper closures have leather thong pulls. About 12" High. Warm as toast even in Arctic weather! Perfect for rugged outdoor wear. Sizes: Small, Medium, Large.

SOLD AT LEADING STORES! Send us your Dealer's Name, or Mail Check or Money Order to **No C.O.D.'s**

DEPT. Y
HENRY MODELL & CO., Inc.
700 B'WAY ● NEW YORK 3, N. Y.

Business Plane

(*Continued from page 49*)

the expedition's treasurer and recorded every last dime, nickel and penny. I might add that I took an automobile owner's satisfaction in recording gasoline at 34 cents a gallon, oil at 40 cents a quart. I looked forward to getting my hands on an adding machine at the end of the trip!

The hours and miles, hundreds of them, passed quickly. We made each appointment on schedule or a little ahead of it. I took the pictures and Mr. Wallace conducted his interviews in Tulsa and Oklahoma City. We finally landed for the night in Big Spring, Tex. As a magazine photographer, I had traveled by commercial air lines in a half dozen countries. But I was quickly being sold on the personal airplane, which you could put down where you pleased, when you pleased, and which could give you a close-up of America from the air whenever desired.

Baggage capacity is always a headache to a professional photographer. Our *Bonanza* amazed me. Each of us carried a large suitcase of personal luggage, and in addition I had three camera cases with complete flash equipment and an extra case of flashbulbs thrown in. All this fitted in the baggage compartment, leaving the cabin entirely free except for a luncheon kit containing two thermos bottles (coffee and ice water) and a lunch compartment which we kept handy for snacks in the clouds.

Nineteen-year-old Dan Wallace, the pilot, has been flying since he was 15. He made some sort of a record in Grand Rapids by getting his private license on his 17th birthday and by now had 550 hours to his credit. During the summer's vacation from college, he had been studying at Northern Air Service (Grand Rapids) for his commercial license and was taking instrument instruction.

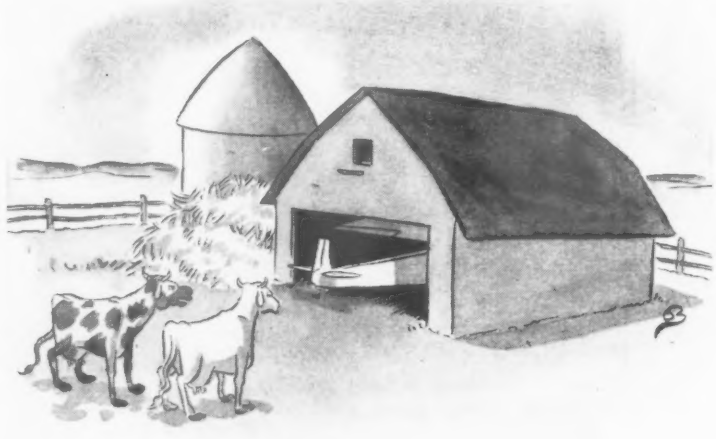
As the days went by, we accomplished our business in El Paso, Phoenix, and had three delightful days in Los Angeles during which I shot my picture story in Hollywood and Mr. Wallace interviewed advertising executives from leading California department stores, including Bullock's, the Broadway, and May Stores. We arrived clean and fresh enough for a tour of the film capital's night spots. No dust, no travel fatigue.

Our flight to San Francisco was a pleasure. We flew up before lunch from Los Angeles and accomplished our appointments that same afternoon. We covered the distance from Los Angeles to San Francisco and made our business contacts all in one day. Try to match that by auto—or any other way for a cost of less than $7 for three people! Then began a weekend we shall never forget. We left 'Frisco early in the morning and put down at Merced, gateway to Yosemite. By telephone, we had arranged for rented automobile service and soon were headed for a wonderful, short vacation among the redwoods.

We headed for Grand Rapids Monday morning via the same southern route. The mountains were no problem whatsoever. With careful navigation and good judgment in refueling about every three hours, the trip was not only much faster but actually much more relaxing than a similar trip by car.

By flying radio beams much of the navigation "checking" task was eliminated and there was little of the fatigue that usually accompanies travel. I smiled when I thought of trying to guide an automobile across country at even 60 miles per hour! There were no hectic traffic hazards up in the sky, and even Dan, our pilot, arrived at each destination relaxed and fresh for business appointments.

When we arrived back at the Grand Rapids airport, I checked over my figures and was overwhelmed at the results. In nine days, we had flown a total of 35 hr. 53 min., leaving all the rest for business, some pleasure and sleep. We had flown 5,499 miles at an average speed of 155.4 m.p.h. Direct air transportation expense for the trip was only $101.65 or 1.8 cents per mile for the plane or six-tenths of a cent per mile per person! END



FLYING "He thinks more of that damn plane than he does us!"

The "Air Supremacy" picture is taking shape

ARE YOU IN IT?

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By the time America's tremendous air supremacy program gets into high gear, the men who begin their training NOW will be ready for employment; and the quality of their training will determine their entire futures. The Industry's recognition of the high quality of AERO TECH graduates makes this school the best possible foundation for your aviation career. The demand for our graduates far exceeds the supply.

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Jets for Civil Planes?

(*Continued from page 32*)

to be pushed to the rear, and that something is gas—gas in the form of air as with the propeller arrangement, or gas in the form of air combined with combustion products as in the jet. It is not quite accurate to think of the propeller as screwing through the atmosphere unless we realize that the air that it chews on must be thrown rearward, and further that the momentum of the gas going to the rear has to be exactly as much as that of the airplane going forward. The principle is called the conservation of momentum.

Conservation of momentum is expressed by a simple equation. Momentum is defined as the mass (weight of the object) times the velocity it has. The equation reads mv = mv. It means that you can't change the momentum in a closed system. This principle is important to our problem because when we use it in connection with the "Work Done" function we have the answer we are seeking.

Let's use an illustration of momentum with respect to an airplane. We have a DC-6 in flight. To keep the figures from intruding on the principle we will assign an arbitrary value to the mass of the airplane and to its velocity. Let's call the mass 20 and the velocity 2, so its momentum comes out as 40. That means that the gas going to the rear has to have a momentum of 40 also; thus it is easy to see that if we are squirting back a small mass of gas we have to squirt it fast. (If we don't, the airplane will slow down until the equation balances.)

Suppose the mass of the gas is 5, then its velocity will have to be 8; that is, the gas will be going back four times as fast as the airplane is going forward, all speeds here being taken with respect to the environment—the air body that we are flying in.

Please note that if we wish to slow down the rearward speed of the gas, we can do so by increasing the amount of it. If we want to halve the speed we have to double the mass. In any case the momentum of the airplane forward has to equal the momentum of the gas to the rear. The importance of this fact will be seen when we examine the effect of what the professor calls the Work Function.

The Work Function is simple, too. The work is defined as the product of the force times the distance through which the force acts. The expression is f x s, where f is the force and s is the distance.

Our DC-6 has a certain thrust pushing it forward. As a matter of fact, the thrust pushing the airplane forward is the same thrust that is pushing the gas backward. The work done on the airplane, the amount it gets the benefit from, is represented by the force times the distance that the airplane moves in a given time, say a second. The amount of work that the thrust does on the gas, the amount that the gas sops up, is represented by the force (thrust) times the distance that the gas moves during the same time.

Distance in a given time is the same as velocity, of course. Now we are getting warm. If the velocity of our airplane forward is 2, as was assigned to it above, and the velocity of the gas to the rear is 8, then the total work done on both the airplane and the gas by the thrust (which must be generated by burning the fuel, doggone it) will be 10; that is, the airplane will get the benefit of .2 of the work while the gas will use .8 of the work, and the latter is a waste.

From time to time I have talked with this and that designer of jets and asked him what advances he was trying to make. One of the major objectives, they said, was to increase the velocity of the gas. "Why?" says I. "To get more thrust," says he.

Well, as we have seen from the Work Function, that sort of thing is paid for by lowered fuel economy, because the faster the velocity of the gas as compared with that of the airplane, the more work the gas will absorb in comparison with what the airplane gets. The military problem often is high speed rather than fuel economy, so we will leave the engineer to write his speeches in peace while we ask ourselves if we can't do the opposite, if we can't slow down the jet velocity and . . . Are we getting hot?

Since the velocity of our airplane is 2, if the velocity of the gas is also 2, the airplane would get half of the benefit of the fuel. Suppose that while the velocity of the airplane is 2 we can make that of the gas on the order of .6. We can't do that? Why not? That is about what the propellered airplane does. Now we have the main reason why the propellered airplane is comparatively so much more efficient; the propeller acts on a large volume of gas and so the gas goes to the rear (slippage) rather slowly, and the airplane gets the benefit of most of the fuel burned.

There is one small point that should be mentioned here as a sort of pacifier for the engineers who will go into a colic when they read this. In a piston engine the gases of combustion are considerably cooled by expansion in the cylinders and this amount of heat goes into useful work, and the slipstick boys will say that this is a point of inefficiency inherent in the jets.

The only cure for such ideas is paying attention.

The general solution to our problem, then, is to design the jet so that it will throw back a bigger volume of gas, and this will be at a lower velocity, for the same power, as we have seen from our two functions. One of the obvious ways is to widen the bore of the nozzle at the rear. (The bustle, to Sadie.) Some of you birdmen can amuse yourselves by tracing out why this is exactly the same thing as adjustable pitch in the propeller engines.

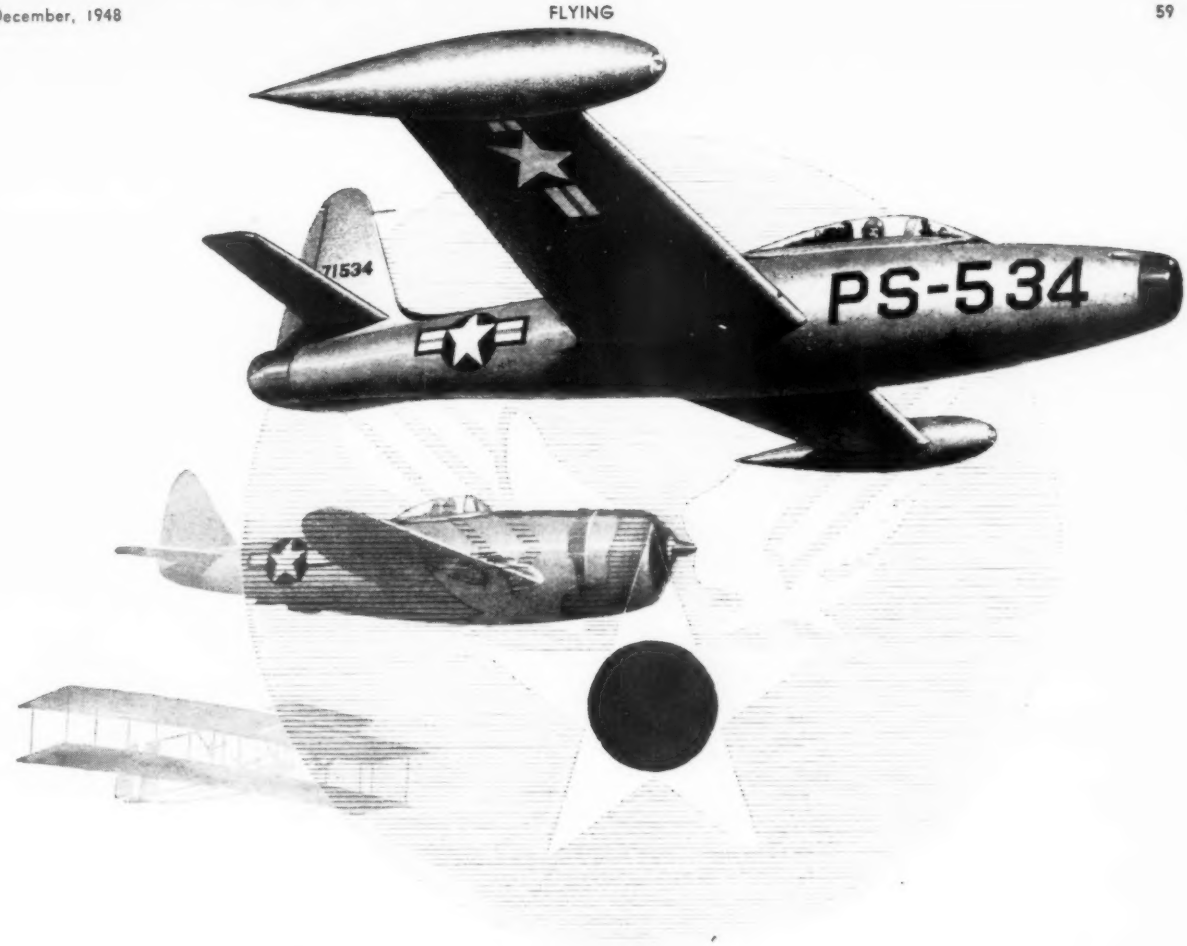
There come to mind dozens of expedients which would be useful in attaining our goal of an economical jet engine. The problem is to choose the best ones. You inventors put down your stenos and get to work.

I would like to predict that we can have economical jets by next year, in the test stage at least. We would like that. But the fireflies won't.

The naturalists assure me that the lady (using the term in its broad sense) fireflies light up their tails as a mating lure. When we get sailing around the night sky with our jets, some of the boy fireflies are going to go crazy. END

HELICOPTER ON A HOSPITAL

THE first helicopter landing atop a hospital took place as a demonstration at Herrick Memorial Hospital, Berkeley, Calif., recently. The pilot brought a Hiller 360 in for a beautiful landing. A few seconds later, doctors, nurses and orderlies took over, moved the "patient" to a waiting gurney and wheeled him into the operating room. The total area of the roof is 250x50 feet and the 'copter field was marked off by a 45-foot square. It took 31 minutes to fly from Palo Alto to the heliport.



PRELUDE TO SURVIVAL

Forty-five years ago at Kitty Hawk . . . Orville Wright soared aloft . . . to make mankind's oldest dream of heavier-than-air flight . . . an accomplished fact. ¶ *Despite a complacent belief that this scientific achievement heralded an era of expanding friendship among the peoples of the earth . . . time has shown that in ruthless hands the airplane can be a frightful instrument of aggression.* ¶ *Only three years after World War II . . . and just a year after the Air Force has commemorated its first anniversary of autonomous operation . . . there is abundant evidence that maintenance of a dominant American air power is a vital factor in discouraging aggressor nations. Republic joins with the USAF in committing our entire resources to this end.*

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"This is the year of the Thunderjet"

REPUBLIC AVIATION

Makers of the Mighty Thunderbolt • Thunderjet • XR-12

Christmas in Mexico

(*Continued from page* 41)

pool strewn with fragrant gardenias.

Stick to the better restaurants for safety. Sanborns, in Mexico City, is world-famous and reasonable. Elsewhere, it's safer to drink bottled waters or beer. There are several excellent Mexican beers (we liked *Carta Blanca*) and pasteurized milk is available as *leche hervada*.

I can't resist a plug for the Fronton in Mexico City. This is jai-alai, the old Basque game, the fastest game in the world. An unforgettable spectacle of speed and skill, and if you're inclined, as easy a way to lose your roll as the ponies.

And, incidentally, don't show your ignorance by screaming "robbers" when you see an ordinary meal on a Mexican menu listed at $3 or $4. The dollar sign in Mexico stands for pesos. Just divide by six, and you'll have the approximate cost in U. S. currency. Mexican prices are seriously inflated now, particularly in the larger cities. Since our trip, the peso—maintained for years at roughly 20 cents U. S.—has dropped sharply in value, and currently is worth less than 15 cents. Even so, living expenses don't exceed and seldom equal the cost of similar items in the U. S.

Meals are available at three to seven pesos in Mexico City and much less in smaller towns. Hotel accommodations cost about the same as in the United States. Our excellent rooms at the newly-completed Hotel Prince in the heart of the city cost 40 pesos, for two. In smaller towns we had equally comfortable though less modern quarters, at 15 and 20 pesos.

My wife and I drove a friend's automobile to Acapulco on the next lap of our journey, while Dr. and Mrs. Clark flew down. It took us 12 hours on the winding 285-mile road; the Clark's *Bonanza* made the trip easily in only an hour and a half.

Clearance from Mexico City was routine. After settling the hangar bill (7 pesos per night) Dr. Clark filed a simple flight plan and paid 3 pesos for a written weather report.

The *Bonanza* lifted quickly despite the altitude, and Dr. Clark flew a 135° course (just to the west of snow-capped "Popo") for 32 miles, then swung to 190° through the canyon. One hundred sixty miles from Mexico City, a final swing to 213° took the *Bonanza* the last 45 miles to Acapulco. This course rounded the spur of mountains extending southwest of Chilpancingo.

Acapulco has two airports, a private field south of town just off the beach (look out for stray burros on the rough gravel runway) and the *Aeronaves de Mexico* field at Pie de la Cuesta, 10 miles north. The private airport, where Dr. Clark landed, had no gas—but expected delivery "manana."

Since aviation gasoline isn't available everywhere on short notice, it's absolutely essential to be provided with letters of authorization from airlines, enabling you to buy gas and oil at their regular supply depots. This courtesy is extended for the asking but the letters must be secured before gas will be sold.

We had such letters from Pan-American and CMA. Incidentally, the Mexico City office of CMA volunteered to radio their airports on our route, giving our approximate arrival dates. We had learned that Acapulco is served by *Aeronaves de Mexico, S. A.*, and had obtained an authorization from this airline, too.

Gas at these fields is usually 91 octane but small amounts of 80 octane are sometimes available. We bought gas by the liter at prices ranging from 50 to 62 centavos (about 40 to 50 cents per gallon). We carried a reserve supply of oil with us.

You can spend a king's ransom at some of the Acapulco resorts, but we were comfortable and close to airport and beach at a Mexican family hotel, The Balboa, for 20 pesos, for two. We had our meals in an open-sided pavilion in a palm grove, cooled by the fresh sea breeze. For two days we swam and were lazy and swam some more, even at night under the moon. Ah, Acapulco! Lotus land!

Since there was still no gasoline at the

(*Continued on page* 62)

DATA FOR MEXICAN FLIGHT

Airport	Nearest Town	Service Facilities	Meals	Hotels
TAMPICO	Tampico, 3 mi.	Gas—CMA, limited emergency repairs, hangar space	About 4 pesos at airport lunch counter	
MEXICO, D.F.	Mexico, D.F., 6 mi. Taxi: 6 pesos	Complete	At Sanborn's: 6.50 pesos for six-course U.S. style; 4 pesos Mexican style	Hotel Prince (45 pesos, twin beds)
ACAPULCO, Private	Acapulco, 1 mi.	Minor emergency repairs only; short, rough runway; no gas, but close to hotel	4-6 pesos at medium-class restaurants	Hotel Balboa (20 pesos, twin beds)
PIE DE LA CUESTA (Aeronaves de Mexico)	Acapulco, 10 mi.	By arrangement only; gas, field storage only	See Above	See Above
GUADALAJARA	Guadalajara, 4 mi. Taxi: 6 pesos	Minor repairs, hangars; usually gas at private hangars	Dinner at hotel: 4.50 pesos	Hotel Roma (15 pesos, double bed)
MAZATLAN	Mazatlan, 4 mi. Taxi: 10 pesos	Gas, field storage (CMA field)	Dinner at hotel: 4 pesos	Hotel Belmar (15 pesos, double bed)
LOS MOCHIS	Los Mochis, 4 mi.	Limited emergency repairs; private gas sometimes; CMA gas by arrangement		
HERMOSILLO	Hermosillo, 2 mi. Taxi: 10 pesos, roundtrip.	CMA gas by arrangement		

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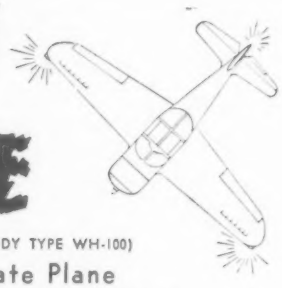

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LOGGING TIME

WITH HY SHERIDAN

Captain, American Airlines

THE STEALTHOSCOPE. If the new brood of stewardesses seem a little better, a little rosier, a bit more mellow than previous hatchings, you can put it down to the fact that they had a more appreciative and, from one point of view, more expert physical examination. The innovation, however helpful, is likely to be ended when this story is read.

American Airlines has under lease a huge Air Force flying field at Ardmore, Okla., where classes of pilots are trained on new DC-6s and Convairs. Classes of new stewardesses are trained there also.

The latest class of hopeful purveyorettes of glamor and gravy had just arrived and been assigned their quarters. The next day was a holiday and they had nothing to do, and they were not too surprised to get a call from the medical department to report for a special examination. They were examined by two well-tanned, dignified, but highly enthusiastic gentlemen in the usual white jackets. The stethoscope work, especially, was quite thorough.

The previous day a captain and his first officer, pilots of the line (in both senses of the word, it may be safely assumed) had ferried in a new plane. When the two resourceful flyers had found the medical people gone for the holiday and two white jackets hanging tantalizingly on the wall, inspiration had its way.

This sort of thing is deplorable, of course, and we must condemn it, through jealousy if not through honor. Yet all of the young ladies seem to have been well satisfied. It is marvelous what even an amateur can do with a stethoscope.

* * *

Sadie the Stewardess is making up a reference book of vice presidents. It will be titled *Who's Hooey.*

* * *

SLEEPER SERVICE

Well, I see that sleeper service has started again. We had it before the war and then it was gone for years. Now it's back again. The only reason for bringing the thing up is that I told you how the girls swell at altitude, and all. Well, a sleeper captain claims that he was asked to go down a few thousand feet until a lady got out of her girdle. The fashion people are going to have to mark these things like the engineers do the planes: "Absolute ceiling 22,000 feet."

* * *

You remember that cover on FLYING with Gypsy Rose Lee? Sadie the Stewardess says that one time she and Gypsy were chasing the same fellow, but Gypsy outstripped her.

* * *

WHITHER, THUNDERHEAD?

Weather scientists are fellows who put down as fact anything that happens to strike their fancy as desirable. Their world is what it ought to be, not what it is. Thus they have given us the cause of the auroras, of the electricity in thunderstorms, and such nonsense.

The textbooks say that the thunderstorm is moving in the direction that its anvil head leans over or its scarf cloud flies out. Every experienced pilot knows better, but you don't have to fly to know it. A little thinking will do the job.

On cold fronts the wind that is below we call a north wind, ignoring the westerly component. The wind above is from the south. Cold front thunderstorms, then, lean and fly their flags north, yet they are going south.

Since the lean of any thunderstorm is a matter of wind gradient, the winds aloft map will show the slant of the tops. The direction that the storm is moving is the direction of the lower air mass that supplies it with energy, or the movement of the front, if any.

Gradually your reporter will straighten out the weather men. The weather will continue to do as it darn pleases.

* * *

SHAKESPEARE ON FLYING

(For the pilot who is a rugged individualist when it comes to running up his engines.)

I must have liberty withal, as large a charter as the wind to blow on whom I please.

—As You Like It. Act II, Scene 7.

* * *

Perhaps this little man with his atoms and his jet planes, who finds this swimming orb too small for him, will find eternity big enough.

* * *

MONTHLY EPITAPH

Here on this mound grows the richest of heather
For below moulds McTavish who didn't check weather.

field when we were ready to depart, we hopped over to the Aeronaves airport. But there—more difficulties. We were not expected; no one at the field had authority to sell us gasoline, and the manager would have to be contacted in town. Finally, after a delay of an hour and a half, we were allowed to purchase our 80 liters and were off.

We followed the beach north 120 miles to Bahía Zihaultenejo (286°). A course of 320° from there to Guadalajara avoids much mountainous country. We chose, however, to fly a little east (332°) which brought us over Paricutín, the new volcano. This sight was well worth the few extra miles. The crater was pouring forth a gigantic column of smoke and ashes towering high above us even at 13,600.

Swinging back to 308°, we passed over Lake Chapala and on to Guadalajara. With a bit of zig-zag, emergency fields are spaced along this 365-mile jump at not greater than 60 mile intervals, though gasoline is probably not available at many.

The Guadalajara airport is used jointly by the Army, the airlines and private flyers. We hangared the plane and paid 60 centavos per liter for gasoline—the highest price charged anywhere except at Los Mochis.

The Hotel Roma, where we stayed on the recommendation of Mr. Delgado of Brownsville, turned out to be a typically Mexican hotel, with high ceilings, enormous bathrooms with showers, and beautiful tile everywhere. Meals are served late: mid-day dinner (the big meal of the day, incidentally) is served from 1:30 to 4 p.m., and supper starts at eight.

To the north and west of Guadalajara lie the threatening gorges of the Rio Grande de Santiago, rivaling the Grand Canyon in ruggedness. To by-pass this country we followed a course (286°) along the railroad until 100 miles out we came to a huge dead crater, our turning point. Twenty-five miles further along our new course (305°) lay Tepic, which has an airfield. We were over Mazatlan in just under two hours. The *aeropuerto*, used by CMA, lies north of town. The manager had received a radio message from Mexico City and was expecting us. He told us that our flying time from Guadalajara was only 10 minutes over their scheduled DC-3 time.

Hotel Belmar has tiled courts, tremendous rooms and a *simpático* manager. The Clarks' suite had a room for the maid and two outside entrances plus a third to a closed court! Rooms here ran 15 to 20 pesos, with six-course meals at four pesos.

New Year's Eve was a gala occasion at the hotel. Several hundred arrived for the excellent dinner which started at 10 o'clock. An eye-widening evening, what with the elaborate coiffures, the beautiful gowns in extreme high fashion, and best of all, what filled the gowns!

We danced in a tiled ballroom to an eight-piece orchestra. At midnight pandemonium broke loose. Everyone sought out friends for the traditional embrace—both arms round and a quick pat-pat on the back, followed by a hearty handshake and *"Felice Año Nuevo!"* I was tempted to try it myself with the little girl in the

red velvet dress. We danced until two, but the party continued until five.

Leaving Mazatlan January 2, we followed the coast 245 miles to Los Mochis, passing an intermediate field about halfway at Culiacan. At Los Mochis we gassed up at a privately-operated hangar. And here we found a discrepancy on the chart: the hills which we saw on the north bank of the river are shown on the south.

Just east of our course (320°) lay Ciudad Obregon and its airport. We detoured briefly to get an airview of Guaymas, nestled among sharp peaks extending out into the blue Gulf of California, before turning inland over the highway to Hermosillo, a little more than 500 miles from Mazatlan.

Here, in accordance with the instructions we received at Brownsville, we telephoned ahead to inform the authorities at Nogales International Airport of our intended reentry into the United States. Since the phone at the airport was for local use only we were forced to taxi to town to place the call.

An hour later, and 160 miles north, we picked up the long strip that lies well to the northeast of Nogales. Following instructions, we remained in the plane while the quarantine inspector completed his report, and our good health and vaccinations were certified by Dr. Clark. A quick check of our baggage, the surrender of our *turistas* to the Mexican Immigration authorities, and it was all over. We were back in the United States, cleared in fifteen minutes. No fees, no fines, no charges for *servicios extra-ordinarios*. END

Ups and Downs

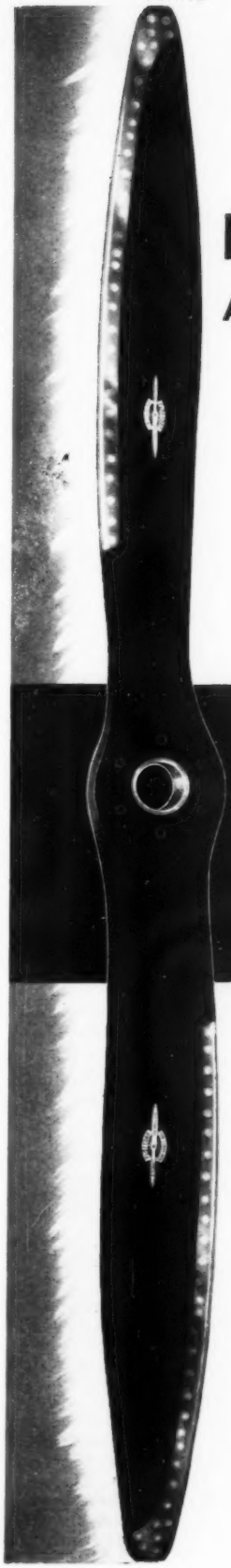
(*Continued from page* 42)

vail, and takes advantage of the updrafts over fields. A slight nose-down attitude, which an updraft makes possible without loss of altitude, will enable some types of planes to cruise faster—a certain military airplane cruises 5 per cent faster than rated if it is first nosed down and then levelled off. A thermal is ideal for this technique in a lightplane.

It should be noted that this technique of "giving the plane its head" does *not* mean to allow it to pitch wildly without some elevator pressure; rather, it means to attempt to hold the airspeed constant with gentle pressures, thus taking advantage of the updrafts and trying to minimize the downdrafts. Like all sage advice to pilots, this too must be modified according to each situation, but in general a pilot can "make money" by following it.

Usually, altitude will increase with careful flying. A few miles from the destination the pilot can work an approach or let-down procedure and lose his altitude at increased airspeed with economy throttle setting, thereby arriving at the field with traffic-pattern altitude. The result is higher groundspeed and a saving of fuel.

Now suppose that it is necessary to hold the altitude constant under VFR, because of marginal altitude above the terrain, minimum ceilings ahead or even during



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a flight test. The air is rough, the airplane is only moderately stable and requires constant attention. Is it possible to set the controls and achieve easier flying? How can those ups and downs be avoided?

The following factors must be considered:

THE AIRPLANE:
- Type of plane: stable or inclined to "hunt."
- Loading (full or partial; location of passengers; location of fuel and baggage).
- Best cruising speed.
- Best cruising attitude.
- Trim or rig (can it cruise hands off?).

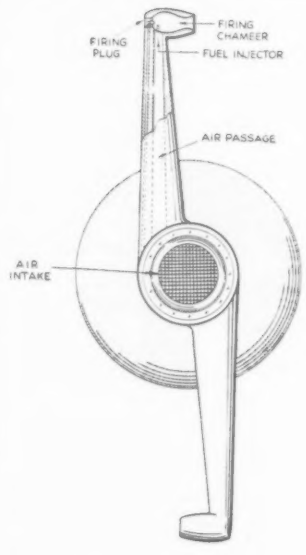
MISCELLANEOUS FACTORS:
- Terrain (flat, mountainous, uninhabited).
- Weather (cumulus, height of ceiling, time of year, wind velocity, gusts).
- Distance from destination.
- Safety (must have more than minimum altitude necessary to clear obstacles).

TECHNIQUE:
- Power setting: Throttle (no creeping), r.p.m.'s, mixture.
- Airspeed used: (cruising, economy, gusty air).
- Carburetor: No icing.
- Trim: Controllable tabs (stabilizer); fixed tabs (aileron, rudder).
- Maneuvering: No excessive turns, no skidding.
- Flight technique: Changes for fuel consumption, passenger movement, and gusts.
- Attitude recognition: Sight, sound and feel.

Assuming a plane with fixed-pitch propeller in the lightplane class, the first thing to do is select a speed at which to fly: economy throttle for long distance (low r.p.m. and most efficient use of mixture control); normal speed for average conditions (r.p.m. recommended by the manufacturer); or slow speed for gusty, turbulent weather (lowest safe airspeed to avoid excessive gust loads). The slower the airspeed, the more difficult it will be to maintain attitude and altitude.

Having selected an appropriate airspeed, adjust the throttle to provide the power required to maintain this speed. Be sure that the power does not change, either from a creeping throttle or carburetor icing; as the lightplane usually has a fixed-pitch propeller, the tachometer is the only power indication available, and a drop in r.p.m.'s indicates either a creeping throttle, icing of the carburetor or a change in attitude. The corrective action is, respectively, to adjust the throttle and *tighten* the throttle, to apply carburetor heat or to resume level flight.

Next, trim the airplane for level flight. This, in one breath, is easier to say and harder to accomplish than one might imagine. The first step is to trim the plane with the stabilizer so that it flies level with "hands off." Note that, as the plane is trimmed, the airspeed changes, necessitating additional use of the stabilizer. For example, the stabilizer tab is moved down, the nose drops and the speed picks up. Enough pressure should be exerted on the elevator to hold the nose in level flight. When the speed becomes constant, readjust the stabilizer so that no control pressure whatsoever is necessary. Now watch the altimeter for gain or loss of altitude: when the plane flies hands off at constant airspeed and constant altitude, the plane is trimmed as far as the stabilizer is concerned. Several fine readjustments are usually necessary to accomplish this.



JET PROP

A JET propeller which has a self-contained power plant has been patented by Walter G. Williams of Cheyenne, Wyo. The prop has an air intake at its hub, and firing chambers at the end of each blade. It is easily adaptable for lightplanes, Williams claims.

An impeller in the hub is geared to the propeller, and forces compressed air into the firing chambers at the blade tips. Fuel is supplied through a small fuel bore.

Power for the plane results from rotation of the blades, as with conventional planes, but blades are turned by reaction from the hot jet blast at the tips.

In some planes a slight modification of this trim may be required. In an airplane that "hunts" vertically, it may be necessary to trim the plane slightly nose down, so that a small amount of back pressure is required to fly level. This, however, is optional.

Notice the lateral and horizontal trim. *Remember, your plane is rigged to fly "hands off" ALL the controls (ailerons, rudder, and elevator) at one speed and one speed only.* If you have selected a different airspeed from the one for which the plane is rigged, the only control that will be "hands off" is the elevator, which has been adjusted with the elevator tab. The others (aileron and rudder) will require constant pressure.

Suppose the speed selected is the speed and r.p.m. recommended by the manufacturer, but the right wing drops, requiring left stick (and possibly some rudder, probably left rudder). As lightplanes are usually not equipped with cockpit-controllable rudder or aileron tabs, this constant veering or falling off indicates either (1) the plane is not rigged properly, (2) the tabs were not adjusted correctly prior to take-off, or (3) the throttle is not set correctly, due to faulty tachometer or airspeed indicator, or the pilot has simply failed to adjust the throttle correctly.

To check the trim, first adjust the throttle to your satisfaction. Now watch the ball-bank indicator, and center the steel ball *exactly* on zero or the center marker by applying enough aileron pressure to level the wings with the horizon, and enough rudder pressure to keep the nose on a given spot ahead of the plane. The latter, of course, should be done either upwind or downwind to avoid complications of drift. Now estimate how much pressure is required to hold the wings and nose in place.

At the next landing field, readjust the tabs. These are usually made of fairly malleable metal bolted to the trailing edge of aileron and rudder. If the right wing drops, bend the right aileron tab *up*: the airflow lowers the aileron and raises the wing. If the nose veers to the left, necessitating right rudder, bend the rubber tab to the left. This will force the rudder to the right. Usually, a change in the rudder tab will necessitate a compensating change in the aileron tab, and several adjustments will be required to achieve perfect "hands off" flight.

Now the pilot is ready to hold a constant altitude. Note the attitude of the plane and the position of the nose on the horizon, note the feel of the controls, and listen to the engine, propeller and airflow. As an updraft is encountered, the angle of attack changes, and lift and drag increase, resulting in gain of altitude, loss of airspeed, change in control pressures, change of attitude, and lowering of the pitch of the combined sound effects. These warnings give ample notice that the pilot must apply corrective pressures to his controls.

But that does *not* mean to fight the controls. The pilot who constantly fights his plane, applying rudder and aileron, turning back and forth from a given heading, or changing his throttle, is doing everything possible to prevent maintenance of a constant altitude. Any turn, especially a skidding turn, changes the airspeed, which in turn alters the required trim, making it impossible to hold an altitude except by constant manipulation of the controls—a vicious circle of error.

The best method is to allow a certain margin of error, say plus-or-minus 50 feet. As the updraft carries the plane upward, get back to the given altitude slowly, because as the old saying goes, "for every updraft there must be a down-

draft." If the gain in altitude becomes excessive, lower the nose and get back to the assigned altitude; if it does not, the downdraft will average out the altitude. If the updraft is both severe and prolonged, the nose must be lowered, which will increase the airspeed. The throttle may then have to be retarded. (Increased speed will change your estimated time of arrival.) Remember, however, that the downdraft to follow will decrease the airspeed when the nose is raised to hold the altitude.

When passengers move around the plane, if baggage is shifted, or when fuel is consumed from tanks which are not located on or near the center of gravity (CG), note the change in control pressures and readjust the cockpit stabilizer tab.

In calm, stable air, the best way to become acquainted with a plane is to practice altitude control by trimming the plane as described above. Then take the hands and feet from the controls to test stability; next place the feet on the rudder pedals and maintain the heading with the rudder alone. While this will cause skidding, the net result is less vertical hunting or pitching, much more relaxation, better observation of the stability of the plane, and good practical experience or observation of how much altitude is gained or lost from thermals, skids or hunting. Most planes will do a better job of holding an altitude than the novice pilot, but from observation of attitude and airspeed, the beginner can become an expert. END

Designing the F-80

(*Continued from page 35*)

struments loaded up with water, water got into the wing tip fuel tanks, and the cockpit filled with water vapors to cause windshield fogging. Furthermore, when water was carried higher than 15,000 feet or so it would freeze solid.

The logical answer to this seemed to be to combine water and alcohol. Alcohol reduced the amount of thrust. Fifty per cent alcohol overcame the freezing problem, but water continued to get into the wing tips and instruments. "And," said Clarence L. ("Kelly") Johnson, Lockheed chief research engineer, "the pilot problem increased because he now became drunk as well as blind." It is necessary, therefore, to shut off all air bleeds from the compressor when the water-alcohol combination is being used. More work is needed here, obviously.

It takes a great deal more power to start jet engines than piston engines. Current surges up to 900 amperes at 24 volts must be supplied for short periods on starting. A special starting cart is usually required, though the Air Force has batteries capable of giving about six to nine starts.

Considerable compressibility research has been done with the F-80A. It was discovered very early that manufacturing differences between each airplane, wing roughness, and so on, affected plane response strongly. Some planes being tested showed a decided rolling tendency before showing any longitudinal pitching

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effect. This may have been due to unsymmetrical formation of wing shock waves. Others would go to higher Mach numbers and develop a gradual nose-down pitching moment. One plane ran into a heavy rain at high speed which severely pitted the wing leading edge paint. It then showed a great decrease in critical Mach number.

Location of the droppable wing tip fuel tanks resulted after wing tunnel tests of eight types of installation. Requirement for carrying large 1,000-pound bombs as an alternative load complicated the solution. The final choice was more efficient at high speed, and though it had an adverse effect on effective wing dihedral it was an advantage in carrying bombs. Safe landings can be made with a full tip fuel tank on only one wing, and many landings have been made with both wing tip tanks on and full of fuel.

During bombing tests, the Air Forces encountered unexpected results from wing tip vortices. Some bombs actually had their tail fins unscrewed by the strong tip currents. When the tails were locked in place by pins through the threads, they were broken off by the high loads encountered.

Great pains were taken to obtain aerodynamic smoothness over the entire airplane. Total drag of the plane is only 60 to 70 per cent of a comparable propeller-driven fighter and there is a wonderful opportunity to take full advantage of laminar flow airfoil design. Such smoothness, strangely enough, doesn't help performance as much at maximum power as it helps cruising speed and climb.

Lockheed set up rigid manufacturing tolerances and used the best available putties, fillers and paints to obtain smoothness. A two-year research program improved the quality of finishes. A selected airplane was carefully tested before and after finishing. It gained only seven m.p.h. at high speeds, but at cruising r.p.m.s it gained 10 to 25 m.p.h.

But if paint deteriorates unduly in service these gains are quickly lost. Paints have not proven as satisfactory as hoped for. High speed paints and fillers should have the ability to withstand temperature changes from +160° to −80° in three minutes or less, must bond firmly with dural, and withstand severe rain at speeds of at least 600 m.p.h. Until better materials are available from the paint manufacturers, Lockheed results showed that true aerodynamic smoothness can be obtained only by using heavy plate construction and grinding to contour.

No particular control problems were encountered within the normal Mach number range of the plane. Using a boost ratio of 15:1, a rate of roll over 150° per second can be reached at intermediate altitudes and much higher rates at 30,000 feet. Complete spin tests show recovery is excellent except with full wing tip fuel tanks. Since the tanks are easily jettisoned, this problem is not material.

A dive flap was found necessary to permit steep dives without exceeding the critical Mach number. Wing dive flaps appeared to cause extremely high balancing tail loads. Cowl flaps caused undesirable tail buffeting and improper trim changes. A fuselage location behind the nose-gear was finally chosen. Without the flap, a dive angle of only 8° can be obtained from 30,000 feet with power off before accelerating to high Mach numbers. The dive flap allows the glide to be increased to 18° for the same speed.

There appears to be no appreciable formation of ice on plane or engine intake. At high speed, the adiabatic temperature rise is between 50° and 70°. Little possibility exists for icing under such conditions. Preliminary experience indicates that jet planes have an icing problem during only very short periods on take-off and landing.

Compressibility effects on the wing caused a high frequency aileron vibration. Many attempts were made to cure this problem, both structurally and by aerodynamic changes. Nothing had any effect. Finally, flight tests showed that the mere expedient of making the aileron ribs stronger and rigging the control cables to 350 pounds or more prevented the oscillations. Cable tensions of 50 pounds or more are sufficient to stop the flutter. No flutter problems developed on elevators or rudders.

Despite rumors to the contrary, no compressibility effects have been noted when firing the six .50-caliber nose guns, even at speeds over 600 m.p.h. Nor have any "mysterious vibrations" been set up which caused the disintegration of the plane. The concentration of these six guns in the nose caused a structural problem which was solved after extensive ground and air firing. Empty cases and links are dumped down a retractable chute. Ten large rockets may be carried under the wings, on a special rack which can be installed or removed in 30 minutes.

The maneuverability of the F-80, and the use of G-suits which increase the pilot's ability to take acceleration have resulted in the plane receiving a rather severe beating in service. The highest load factor recorded on an F-80 has been 11.3Gs, during gunnery tests too close to the ground. In tests, over 9G acceleration has been held throughout a 360° turn. Loads of 8Gs are quite common.

Lack of dependable means for preventing engine overspeeding has overstressed turbine wheels in many cases. Turbine wheels have also failed in cases where overspeeding was not present. In a number of cases the wheel has split and flown through the fuselage, or even sheared the aft end of the plane off completely. In one case, a large piece of the turbine wheel was found six miles to one side of the flight path. No practical means has yet been found to absorb the energy from a large split turbine wheel to prevent it from doing great damage. Reliable governing is a must to control turbine speed.

Development of the F-80 pointed to the need for solving a number of important jet problems. Here are some of them:

AIRCRAFT

1. Better navigation and low visibility landing facilities.
2. Improved take-off performance.
3. Improved crew escape facilities at high speeds.
4. Better landing gears, tires and brakes, or other means for deceleration.
5. Reliable anti-flutter devices.
6. Reliable fire detection and extinguishing means.
7. Electric windshield and canopy defrosters and deicers.
8. Suitable fillers, putties and paints to obtain aerodynamic smoothness.

ENGINES

1. Better over-all reliability.
2. Dual fuel systems.
3. Lower fuel consumption.
4. More take-off thrust.
5. Better acceleration from low r.p.m. (now satisfactory for high r.p.m.).
6. More reliable governors.
7. Better power controls.
8. A dry air pressure source when using fluid injection.
9. Less fuel leakage from engine on starting.
10. Better starting characteristics, particularly at altitude. END

15 YEARS AGO

FROM the December, 1933, issue of this magazine:

Admiral Byrd was preparing for his second Antarctic trip. (See photo) His equipment included a Curtiss-Wright *Condor* plane with two Wright Cyclone engines of 575 h.p. each; a single-engined 575 h.p. Fokker plane; and a Pep-Boys Snowman Autogiro with a 220-h.p. Kinner engine.

The Douglas DC-1 was the latest transport. Built for TWA, it was an all-metal low-wing monoplane powered with two Wright Cyclone engines. Top speed at 12,000 feet was 210 m.p.h.; cruising speed was 186 m.p.h. Twelve passengers could be seated in two rows of six seats each, but the width was sufficient to accommodate 18 persons without crowding.

France's new military plane, the Potez convertible Type 49, could be converted from a monoplane to a biplane depending on its mission. The monoplane wing was of cantilever construction supported by a "V" strut. As a monoplane, it was excellent for observation work and a third seat was available behind the observer's chair. In 15 minutes the plane could be changed to a biplane bomber by attaching a second wing below the first. As a bomber, it could carry four 220-pound bombs or smaller bombs up to that weight.

A Taylor Cub broke the world's endurance record for lightplanes when it stayed aloft 12 hr. 28 min. The plane was powered with a 40 h.p. Continental engine and piloted by 19 year-old Mary Campana of Youngstown, O.

TWENTY YEARS AGO

On the 25th anniversary of their first power flight, the magazine was dedicated to the Wright Brothers. It was on December 17, 1903, that Orville Wright made the first flight in a powered airplane.

The Mighty Force of Kinetikos

(*Continued from page* 45)

It boils down, for practical purposes, to the fact that the average personal airplane has a factor of safety of approximately 6.0. If the airplane is dynamically overloaded beyond that point it will fail structurally.

Airplanes are really much stronger than novices imagine. But, likewise, novice pilots too often have no conception of the terrible stresses they may be putting on their planes through careless handling. And that is where an understanding of kinetic energy becomes important.

The important thing to understand is that *kinetic energy is proportional to the square of the speed of motion.*

Assume that a plane is flying at 100 m.p.h. Then let's give the plane's kinetic energy at that speed the value of X. Now increase the speed of the plane to 150 m.p.h. The energy is not $1\frac{1}{2}$X but 2.25X. How do we arrive at that figure? Simply by taking the square of 100 which equals 10,000, and comparing it with the square of 150, which equals 22,500. The square of 150 is 2.25 times the square of 100.

Similarly, the kinetic energy at 200 m.p.h. is 4X. At 250 m.p.h it is 6.25X. At 300 m.p.h. it is 9X.

Although speed increases arithmetically, kinetic energy increases geometrically. Speed makes kinetic energy grow until it is overwhelmingly powerful.

Not so long ago, a locomotive engineer driving a fast passenger train hit a curve just a few miles an hour faster than the "never exceed" rate in the rule book. The kinetic energy stored in the train's fast-moving bulk tended to keep it going straight. Something had to give. In this case it was the rail. There was a bad wreck and heavy loss of life.

The wings of an airplane serve much the same purpose for the fuselage as rails for a train. They support it and give it direction. And just as the rails give way if subjected to strain beyond their design limit, so will the airplane's wings tear from the fuselage if put to a test beyond their strength.

Increasing the speed of an airplane in level flight in smooth air causes little or no increase in structural stress. But in gusty air or when the flight path of the plane is altered by the pilot, stress builds up rapidly—just as in the case of the railroad train.

During flight in rough air, wing stresses change rapidly. Usually the "bumps" caused by gusts are not pronounced enough to exceed the safety factor built into airplanes. That is because planes are usually flown at normal cruising speeds. But at extraordinarily high speeds a severe gust may cause a wing to fail. Again the same law of kinetic energy applies:

The stress imposed by any gust will be approximately proportional to the square of the speed at which the airplane is traveling.

Wise pilots adjust their margin of safety to rough air conditions. Suppose your plane cruises at 150 m.p.h. Usually you will slow down on entering a storm or unusually rough weather. But how much? It's a question of how much you want to increase your real margin of safety. If you want to double it, of course you don't halve your speed. The exact method would be to square 150, which would give you 22,500, divide it by two, which would give you 11,250, and find the square root of 11,250, which would give you about 106 m.p.h. If you think 106 m.p.h. is too slow, you might try 125 m.p.h. That would give you about a 50 percent better safety margin than 150 m.p.h.

These slower speeds give you an increased safety margin by reducing the intensity of any bump you encounter. Of course no one expects you to figure out problems of square root while you're in flight, and especially when you're fighting a thunderstorm. But it would be wise to have them figured out ahead of time.

Beware, especially, the dangers of sharp pull-out. The elevator is capable of producing an overload on the wing structure that is *proportional to the square of the ratio of the plane's stalling speed to the flying speed at the moment.* If the airplane stalls at 50 m.p.h., an overload of nine times normal can be exerted by violent use of the elevator at 150 m.p.h. and 16 times normal at 200 m.p.h.

Small light trainers may stall at 40 m.p.h. or less. Remember that when you pull out of a dive or a practice

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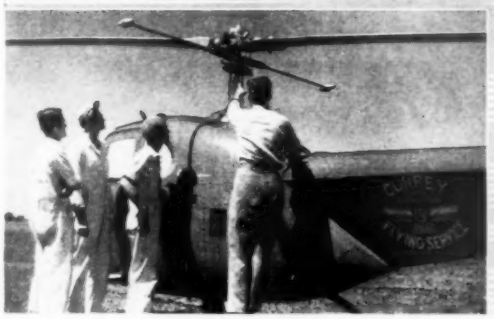

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GRANDMA'S FREE FLIGHT LESSONS

• THE CASUAL TOUCH

Carl A. Bollinger, chief test pilot for Republic, parachuted 12,000 feet into the Atlantic near Quoge, L.I., when the F-84 he was testing disintegrated. When rescuers reached him he was bobbing in a Mae West and sucking a cut finger. "Hi, there," he said casually.

• CROSSROADS

It's probably the only one in the world, but in Anchorage, Alaska, there's a stoplight to keep airplanes and autos from tangling at an intersection. The light is at Merrill Field, where the Palmer Highway passes an airstrip. Sometimes cars are stopped for two blocks, waiting for planes to land or take-off.

• FLYING YOUNGSTER

Taking a 50-year-old friend for a flight in his plane, Starr Nelson of Delta, Colo., explained: "I just wanted to show the kid the sights."

Nelson is 82. He's been piloting a plane for nine years now—"ever since the railroad company decided I was too damn old to run an engine."

In one week, Pan American World Airways lugged the following items: 15 dogs, two love birds, 7,000 worms, one alligator.

• HON. TALL TALE DEPT.

It is just about decided that the biggest whopper the Japanese told during the war was a dispatch that a Jap fighter plane had "rammed a hole clear through a B-29, came out on the other side undamaged, and continued to fight."

• SPECIAL DISCOUNT

The Chambersburg, Pa., Flying Service has offered to give free flight training to anyone over 60—and Mary Wingert, a grandmother, has taken them up on it. She gets a half-hour lesson daily, and as she approaches her 61st birthday says, "I'm crazy about flying." She got the flying bug when her son, Earl, took her for a hop."

The Oklahoma City council has decided seaplanes may land on Lake Hefner, despite protests from the state game and fish department. The department says the noise of planes makes the fish neurotic.

• PROPPED UP

Joey Ludovici of Woonsocket, R.I., is seeking permission from CAA for a solo license. Joey is 11. He props himself up on four generous-sized pillows when he takes over a seat by the plane's instruments. He made his first flight at 18 months, sitting on his father's lap.

• CRASHED THE PARTY

It will be a long time before John K. Lepper forgets his crash-landing near Parryville, Pa. The Hellertown, Pa.,

pilot was helped from his downed craft, unhurt but blushing, by rescuers. He had landed in the midst of a nudist colony.

• UNROMANTIC BOVINES

Martin Bowditch, a 21-year-old pilot from Lawton, Mich., found himself arrested—all because a herd of cows didn't appreciate romance. Bowditch flew over a farm and dropped a note to his girl, asking for a date. A herd of cows on a neighbor's farm stampeded. Bowditch was charged with low flying.

• FLYING FOR FUN

Actor Kirk Douglas flew 3,000 miles just to say three words in a movie. He winged all the way from Hollywood to Stamford, Conn., where "A Letter to Three Wives" is being filmed to tell Ann Sothern, "Have fun, darling."

• ELEPHANTS YET

In Sweden two elephants were loaded on a DC-3 while various experts measured headroom, hindroom, breathing space. Then the elephants were marched out again. The whole thing was done just in case someday somebody might decide to ship an elephant by air.

—Harold Helfer

spin. If your needle says 100 remember that the ratio of 100 to 40 is 2½. Square 2½ and you come up with 6¼. Structural failure is almost certain to occur at such a load factor. Take the stick back gently; don't give it a suicidal yank that can strip your wings off.

If you fly cross country a great deal you may some day find yourself flying instruments quite unexpectedly. You will be over broken clouds, technically contact, and find suddenly that there aren't any more breaks and you really are on top.

You don't know how thick the blanket is beneath you and you have only one desire—to get down. At first you try to turn back but you find that it has closed in behind you, too. What do you do now?

If you're not completely lost; if there are no tall buildings or mountains or tall chimneys in your vicinity, here's the procedure.

First, climb to about 500 feet above the clouds. Now, slow down to normal gliding speed. If your plane has flaps and retracting gear, extend both. Keep your engine turning at a fast idle—just fast enough to keep it warm. Next, trim your plane with whatever controls you have—elevator trim tab, or stabilizer—so it will maintain the normal glide with hands off the wheel or stick.

Then begin your descent to cloud level. On the way down, check the plane's stability. Make whatever adjustments are necessary *but don't use the stick.* Keep your eyes firmly on the turn indicator and keep it centered by using the rudder. It is not necessary to keep the turn needle precisely in the center. When you move the rudder pedals, do it gently. This procedure will keep the plane from diving or climbing violently, and from turning or spiralling. Pilots not skilled in instrument flying almost invariably get into some such maneuver when they try to fly in dense cloud. That's when kinetic energy builds up. That's what causes all these blind flying accidents.

Nervous pressure under instrument conditions sometimes robs inexperienced pilots of all ability to coordinate hands and feet, or to know left from right. A panicky pilot, suddenly seeing the altimeter unwinding and the air speed shooting up, is likely to pull the stick back hard.

That's what causes all these kinetic energy accidents. That's when the wings and fuselage part company and the eyewitness on the ground says the plane exploded in mid-air.

That won't happen to you if you remember this lesson on kinetic energy and use the glide system to get back to contact flight. *The plane will fly itself better than you can fly it.* It will go into the clouds right side up, going straight and slow and trimmed to stay that way. And unless the air is unusually rough, it will break out at the bottom of the clouds in the same attitude with no help from you aside from ruddering to keep it from sliding off into a slow spiral. You play it that way and you will see your grandchildren solo. END

I Learned About . . .

(Continued from page 52)

executed the prettiest "bale out" on the ground, making a perfect three-point landing on her fundiment.

The *Champion* was now completely on the loose, without a guiding hand, and breezing around the airport with the propeller turning over at darn close to 1,600 revolutions per minute. There were five or six aircraft on the line, a newly-constructed hangar, office and lunch room, all in the area of potential destruction. It was necessary to prevent damage not only to the Aeronca but also to the operator's valuable equipment; otherwise, perhaps a lifetime of paying off the debt.

The plane started diagonally across the runway, heading for the far side of the field, with me in hot pursuit. It followed a zig-zag course and each time it ran over a rock or a slope or a rise in the turf, it swayed in unpredictable directions. Catching up with it on the far side of the field, I lunged for the leading edge of the wing, could not hold back the thrust and was thrown to the ground. My body action against the wing changed its course; the plane executed a perfect 180, and headed for the other side of the pasture, pointing directly towards the parked planes. I picked up my bruised body and once again caught it about 50 yards short of the parking area. In a bold leap for the wing I missed it completely but did succeed in enveloping part of the empennage. I held tightly for about two seconds, but once again found myself on the ground with the plane heading on a course parallel to the runway.

At this point one of the mechanics joined the chase. Without his aid, the plane never would have been stopped.

The mech and I held a quick council of war, made an estimate of the situation, and decided that if we did catch the "frightened rabbit," flying tackles were not in order, as our ribs could stand only so much. The scientific approach must be used—hold on to the wing-tip, get the plane rotating in a circle around the axis. The other scientist could then run around the inside of the circle, reach into the cockpit and cut the throttle.

Theoretically, it was fine—but first we had to catch the plane, and then put the theory into practice. We were lucky. The plane hit a runway marker, caromed off it, and proceeded up an incline, slowing up slightly. I grabbed the wing-tip and, surprisingly, found it quite simple to keep the Aeronca moving in a circle around me. The mech ran around the inside of the circle until he could reach in and cut the throttle. Then with the plane slowed up, I scrambled over to the door, jumped in and cut the master switch.

We made a thorough inspection, and found the plane undamaged—no scraped wing tips, no chipped propeller, no broken landing gear, not a scratch. Frances had a few black and blue marks, my ribs were bruised, but we thanked our lucky stars for a happy ending to a situation which could have been disastrous, possibly fatal.

Not only did I learn about flying from that, but I learned never to underestimate the power of a Lycoming engine. END

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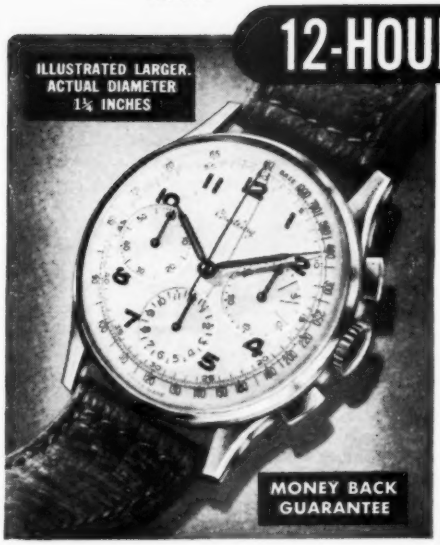

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Bail Out at Midnight

(*Continued from page 44*)

packets, instructions, guards for the ship, communications to the nearest Naval authorities, and old Boucher off somewhere hung up by his trousers in a treetop freezing to death.

She pointed ahead and I had the surprise of my life. Instead of a crashed ship dug into the ground, there sat the "J" as though she had made a perfect belly landing with a ghost pilot at the controls.

A very small oil fire had started and was struggling to make progress, but a man was there calmly extinguishing this flame with a small CO_2 or carbon tet bottle. Whether he reached into the plane and got it or whether the jolt of the landing threw it out, I'll never know. He had been driving down the road to visit the farmerette and had arrived just in time.

We piled into the farmer's car and headed for the nearest whistlestop. It was now around 11 P.M. and we were figuring out how to find Boucher. I hated to wire the Navy that the ship was relatively okay but that one of our intelligence officers was missing. Besides, Boucher was a shipmate and a friend. We decided to raise the sheriff.

We could pinpoint Boucher's position roughly on a wall map, and the town was sufficiently large to have state radio patrol cars in the area. They systematically combed the roads and in no time radioed back that they had found him.

Now, to get a pair of shoes. The stores were all closed and shoe coupons were in vogue, so considerable discussion followed on how to go about digging up a pair.

The boys phoned the local shoe store owner and had him go down to his place and open up. His family, in turn, phoned the local powers and got authorization to sell a pair without a ration coupon. Then all of us sat around for awhile in the sheriff's office shooting the breeze and killing time until Boucher returned.

Shortly, a patrol car drove up and in walked Boucher dragging all our gear and luggage. He had gone to the plane on the way back, opened up the baggage compartment and removed everything intact. He even thought to look on the deck of his cockpit for his cap and found it.

Boucher grabbed the phone in a hurry and called his friend in D.C. and told why he was late and so on, but she refused to believe his story. The deputies and state troopers had a big laugh watching him plead over the phone. He finally won out and all ended happily.

We piled into a bus later and rode into Washington.

Several days after our midnight bailout Commander Boucher could be found in the officers' wardroom of the big Essex-class carrier. All was *tres gay* with two large cakes on a table for a friendly welcome to a new air group assigned to fly from the *Bon Homme Richard*.

The "Exec" had called all pilots of the group and all officers of the ship not on duty into the wardroom for the celebration. There must have been 80 or 90 pilots plus 20 or 30 ship's officers. I was in my stateroom dressing when a call came over the bullhorn for Lieutenant Pressler to report to the wardroom. As I walked in and saw everybody standing around with an air of expectation, I froze for an instant and then did my best to be inconspicuous and affable. I nodded to various friends and observed, at the same time, all the braid of the ship grouped together with Commander Boucher among them. All eyes were focused on me now and I knew this was it.

The "Exec" called me forward quietly and then turned to the assembly in general and announced that Commander Boucher had a statement to make.

Boucher stepped forward. "Gentlemen, we have the honor of making a special award tonight to a member of our company. Lieutenant Pressler," (and, with that, he turned to me, holding a large square box) ". . . Pressler, at this time I think it fitting and proper to present you with this high award for your gallant action and superior ability in night navigation above and beyond the call of duty. Your recent exploit will be held up as a challenge to all airmen and will long be remembered in the annals of naval aviation history. It gives me ex-treeem pleasuuure," (with feeling) "to present you with this award for your outstanding performance." He handed me the contents of the box which he had removed by now, and stood looking at me in a very satisfied manner.

Gingerly, I accepted the award from him, forced out a weak smile and said, "Thank you, sir." All hands were grinning by now except the skipper. I continued with some words about appreciation and the really insignificant role I had played.

I glanced down at my new possession and raised it for all to see—a shining, sparkling white, perfectly beautiful chamber pot replete with an attractive curved handle and, s'help me, lined throughout with lovely soft fur. Yes sir, a real honest-to-God fur-lined chamber pot, all for me. Of such stuff are heroes made. END

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School for Survival

(*Continued from page* 37)

on the occupants. Soon a sheath of glazed ice adds to the insulating qualities. Meals are cooked on a gasoline stove compact enough to fit into a parka pocket. To prevent carbon monoxide from accumulating, vents are made near floor level.

To build a snow house, the instructor drives a stake in the snow and attaches a string to it, drawing a rough circle in the snow. Then he cuts blocks of snow and places them on the circle. Each block is properly bevelled on the ends with a saw—with the saw pointed towards the center stake for reference. As the work progresses, the blocks are trimmed to size and pushed into place. The circle spirals around and up until there is finally only one keystone block for the top. It holds the others in place and without it the whole structure might tumble.

As soon as a snow house is built, snow is thrown over the whole surface and a fire is built inside, causing the ceiling to ice up. Instructors then inspect the shelters for flaws—such as too large an entrance, improperly placed vent, straight rather than arched walls, and entrance too near the main room rather than extended with a tunnel to prevent danger of cave-in.

The men are taught to fish. A native instructor uses two poles. A line with a barbless hook is attached to only one of the poles. When the fisherman has a bite, he weaves the poles across the line until the fish is out of water. Then, with a simple shake, the fish is dropped off the barbless hook to the ice and the line slides down the poles into the water with the fisherman still wearing dry mittens.

Netting crabs is another source of winter food. The crabs are large and delicious and, with the fish caught by the barbless hooks, may mean the difference between survival and starvation for a crew downed in the Arctic.

The men are drilled intensively on the dangers of cold and carbon monoxide. Belly-landed planes might have enough gasoline left in their tanks to keep a crew warm for months—but gasoline burning in a snow shelter forms carbon monoxide and the men must learn how to ventilate their caves and houses. Smart guys who disbelieve the warning to keep dry soon regret their carelessness. Even snow clinging to outer clothing is carefully brushed off before entering a heated shelter. Within the shelter it would melt, seep inside the clothing, and when the man went outside again he would find his clothing lined with icicles.

The aim of the Arctic Indoctrination School is to train men to stay alive until they are rescued. The 10th Rescue Squadron is in charge of rescue operations in Alaska, and is prepared to fly missions night and day. Its equipment includes everything from various airplanes to special delivery para-dogs. Graduates of the indoctrination school have this to comfort them on their long flights over the Arctic Ocean, even to the North Pole. The means are at hand to rescue them should anything happen. And they are trained to care for themselves until help comes. END

Jets of U. S. Air Forces

(*Continued from page* 18)

operational Air Force jet fighter. Hundreds of these are on order. Both the F-80 and the F-84 have been officially timed at over 620 m.p.h. Then come the McDonnell XF-85, a tiny parasite fighter with folding wings which is to be carried inside the giant B-36 bomber to protect it on long-distance raids; the North American F-86, with swept-back wings (see "The F-86, World's Fastest Fighter," page 15, November FLYING) which is now going into fairly substantial production; the long-range Curtiss XF-87 (*Blackhawk*), an "all-weather fighter" which carries two men and can fly 2,400 miles; the McDonnell XF-88, fast and long-ranged; the Northrop XF-89 night fighter, which will have remote-controlled gun turrets; and the Lockheed XF-90, Republic XF-91 and Consolidated XF-92, which have both turbo-jet and rocket engines. These latter three, each faster than the preceding model, range into supersonic speeds.

The Navy also has two operational jet fighters, the McDonnell *Phantom* (FH-1) and the North American FJ-1. A number of other faster types are in prototype or in limited production. These include the Chance-Vought *Pirate* (F6U-1), the McDonnell *Banshee* (F2H), the Grumman *Panther* (XF9F), powered with a British-designed *Nene* turbo-jet, the twin-jet Douglas F3D-1, Grumman XF10F-1, Chance-Vought XF7U-1, and McDonnell XF3H-1. Besides these, the Air Force's F-80, with minor modifications, has completed carrier trials and two-place trainer versions of the plane are on order.

Some of these airplanes have swept-back wings to enable them to sneak up on the sonic barrier. Most of them have speeds over 600 m.p.h. and some are expected to fly over 700 m.p.h. Because of greater fuel requirements, the longer-ranged craft among them have to be much larger than old-time fighters to gain sufficient range. The Curtiss XF-87, for example, weighs more than a medium bomber of World War II.

Jet Bombers

Bombers include such planes as the Douglas XB-43, an experimental jet version of the ill-fated *Mixmaster*, which had two contra-rotating props driven by Allison piston engines buried in the fuselage. The B-45 is a North American plane propelled by four turbo-jet engines and designed to be the first American operational jet bomber. It has a range estimated at more than 2,000 miles and a top speed over 500 m.p.h.

The Convair XB-46 is a beautiful long, slim, four-jet bomber, still undergoing test at Wright Field. It would have a range of about 1,500 miles and bomb load of 10 tons. It has only a three-man crew. Extremely promising in this group is the Boeing XB-47, powered by six turbo-jet engines, two under each wing and one at

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each wing tip. This big plane has thin, sharply swept-back wings with a 116-foot span. The Martin XB-48 has a 108-foot span and is also powered by six jet engines. It can carry over 10 tons of bombs for medium ranges.

The Northrop YB-49 is the jet version of the gigantic B-35 flying wing and has eight jet engines which propel it over 500 m.p.h. It has a 172-foot wingspan and probably weighs over 200,000 pounds fully loaded. Air Force officials are said to be extremely optimistic about its use as a long range jet bomber. There have been rumors about a projected Martin XB-51 and Convair XB-53, both presumably cancelled. The latter would have been especially interesting, since it was to have swept-forward wings.

Propeller-Jet Combinations

Propeller-jet combinations take several forms. They all have jet engines in the rear—but may have either piston engines or gas turbines driving propellers in the nose.

The Consolidated XF-81 had a "prop-jet" or gas turbine driving a propeller in the nose. This plane was designed to have a 2,500-mile combat range and a 500-m.p.h.-plus speed. The Ryan XF2R-1 had a General Electric gas turbine to drive the propeller through gears and another GE turbo-jet for rear thrust. The gas turbine-propeller problem has been proving more difficult than originally anticipated, however, mainly because of the difficulty of gearing down high turbine speeds to propeller speeds. A third in this group is the Boeing XB-52, a giant bomber scheduled to use new Wright turbo-props. Another projected Navy fighter using turbo-props is the Convair XP5Y-1, a fast flying boat.

More common are the piston engine-jet combinations, all of them Navy planes. The Grumman XTB3F, still in development, is a torpedo bomber with a piston engine in the nose and a jet in the tail. The Lockheed XP3V is a turbo-jet and propeller version of the *Neptune*. Two fighters are the Ryan *Fireball* (FR-1) and the Ryan XFR-4, the latter with better than 500-m.p.h. speeds. There is also a long-range patrol plane, the Martin P4M-1, which has piston engines in the front of each of its two nacelles and Allison jets in the rear. It is a land-based plane designed for sea patrol duty.

These are virtually all of the new U.S. jets. Air Force propeller-driven fighters are being replaced as rapidly as possible. The Navy is not converting so rapidly because jets are more difficult to operate off carriers but these problems are rapidly being solved.

Jet bombers, though, are more experimental. For at least the next two years, and probably longer, the Boeing B-50 will be our standard heavy bomber, supplemented by modified B-29s. But both are interim airplanes for the very simple reason that jet bombers are 200 m.p.h. or more faster.

Design Problems

The jets will take over as experience is gained in design and production. Problems in each are not fully known. The wing skin of the Bell X-1, for example, could not be built out of ordinary aluminum sheet and riveted onto framework as in the planes of World War II. It had to be machined out of heavy stock. Even so, after nearly two years of testing, this plane has not begun to approach the maximum speed at which its rocket motors are capable of driving it.

Despite the great gains that have been made in 10 years of jet engine development, and the present limits of structural strengths which restrict aircraft speeds, the search is on for more and more power. Higher speed is not the only goal; faster take-off and better altitude characteristics are also necessary. Better compressors would increase range materially. A jump of pressure ratio from four to 25 at a turbine inlet temperature of 1540° would add 45 per cent to the range of present jet fighters cruising 500 m.p.h. at 30,000 feet.

Better metals to increase operating temperatures also would add to efficiency and performance. Metallurgists are experimenting with such rare metals as zirconium, tantalum and stellite for turbine blades. They combine high strength with ability to resist corrosion, and alloys made with them might well be revolutionary.

It has always taken four or five years for a new airplane model to be designed, built, tested, and put into quantity production. During World War II the United States did not have in combat a single airplane the design of which was not in existence at the start of the war. The difficulties of design and construction are compounded with the new jet planes. The days when unskilled laborers could be taught to build aircraft in a few weeks are over—the skilled machine work now required often takes years of training.

Fortunately, Congress has appropriated enough funds to finance sufficient new planes to maintain and build up these necessary skills. Large amounts have been made available for research, for testing, and for pilot orders. The biscuit-cutting days of warplane construction and the rule-of-thumb days of design are long past. Today both are precision jobs. END

WAR IN FLORIDA

NAMORO declared war on Deluvia at Eglin Field, Fla., recently.

The two hypothetical nations battled each other in a series of five weekly exercises directed by the Ninth Air Force, and called "Operation Combine III." The maneuver demonstrated to over 3,500 service school students the technique of large scale air-ground attacks, and involved planes and men from the Navy, Army, Marine Corps and Air Forces.

Five hundred planes, 100 of them jets, and 8,500 men (including some 484 paratroopers) took part in the October maneuvers.

Highlight of each of the weekly exercises was a giant aerial demonstration directed by means of extensive radar and radio facilities of the Ninth Air Force's Tactical Air Control Center at Eglin Field. On one of the typical demonstrations, over 41 aerial missions were coordinated and flown in slightly over 3 hours, without deviation from a minute-by-minute schedule.

Photos show (top) some of the 484 paratroopers who jumped during the maneuvers. These troopers were members of the famed all-Negro Third Battalion of the 82d Division.

Small photo shows one of the demonstrations in which students from armed service schools were taught how to coordinate air-ground attacks.

Mooney M-18

(*Continued from page* 39)

3,900 for take-off. Mooney's present plan is to set up an arbitrary 250-hour replacement period for all power plants that go out in these little planes. He's setting the figure at 250 hours just to see how this equipment wears in the hands of average users. He feels that 1,000-hour replacement will eventually be common. For the time being, though, he wants to take back each power plant unit after 250 hours, exchanging it for a new one that will be installed in the customer's plane. Mooney's main concern is to make a careful check on the lubrication of the propeller-drive bearings, the one thing that actually caused trouble in early tests.

For all its modification, the engine is quite heavy: four pounds per horsepower. Reason, of course, is that it is basically an automobile engine with few of the lightweight, though expensive, aircraft parts. The Tillotson carburetor is the same as that on the automobile engine. So are the ignition system, the spark plugs—even the liquid-cooling system, which carries 1.8 quarts of coolant (40 per cent Prestone or Zerex, the rest water; this mixture is used the year-round).

Because the power plant unit is by far the heaviest part of this tiny plane, it contributes more than anything else to the plane's unsatisfactory take-off performance. The Mooney M-18 has been licensed with a power loading of 28 pounds per horsepower — considerably higher than any other personal plane I know of. That compares, for instance, with the *Bonanza's* power loading of just over 14 pounds per horsepower. After flying this airplane for more than an hour, I couldn't help think of the performance this excellent little airplane might have if it had a higher-horsepower aircraft engine which could be installed for the same weight. But the reason this hasn't been done is simply cost; while Mooney could probably double the horsepower for the weight, the cost would increase tremendously.

The fact remains, however, that the M-18 does have critical take-off performance. I don't recall ever having spent so much time getting a plane off the ground. A couple of times it took me over 15 seconds to get off of a macadam runway and into a 20 m.p.h. cross wind. Some of this was due to my inexperienced handling of the very sensitive controls. But even when the plane is flown by a company pilot it takes quite a while to get airborne. Factory specifications say the ship will get off in 600 feet. The CAA performance figures for the airplane taking off and climbing 50 feet, at the altitude and temperature at which I flew this airplane, call for a distance of nearly 2,400 feet.

And because this take-off performance is so critical, anything and everything affects it. There's a pronounced difference between a take-off from a hard-surfaced runway and from a grass field, with the grass slowing take-offs percep-

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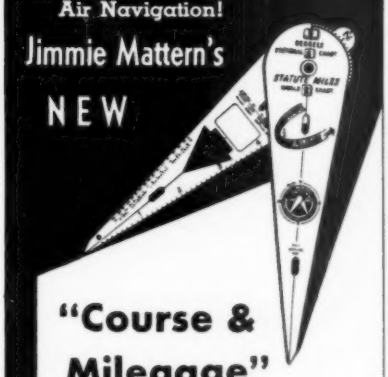
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tibly. Despite the strong wind that blew during the time I was flying this airplane, I never timed a take-off at less than 15 seconds—which compares with a number of four-second take-offs I made with an 85-h.p. Taylorcraft in a 10-m.p.h. wind just two days earlier. . . . But I'm getting a little ahead of myself.

You can't very well get checked out in a one-place airplane. So you just climb in, a pilot shows you the various controls, knobs and buttons, tells you how to use them, and that's that. The Mooney people wanted to make sure I knew how to operate the retractable landing gear, however, so a couple of men lifted the wings, put a sawhorse under each, one man held the tail down, and I was ready to try the gear a couple of times. This gear is retracted manually; there's no electric motor or hydraulic pump to help you. There's a counterbalancing weight somewhere in the mechanism which is supposed to make it easy for the pilot to retract the gear quickly after take-off.

So aside from getting a chance to work the gear a couple of times on the ground, you don't get a chance to feel out this airplane until you fly it. I was shown how to operate the simplified trimming device (very much like Mooney's Simpli-Fly system on the Culver V), the engine and flight controls, and then I was on my own.

The engine doesn't have a starter so I held the brakes while a man cranked the prop. The engine starts up with a roar and immediately starts running so fast you think you're over-revving it. But one look at the slow-turning prop is enough to remind you that the engine is supposed to sound that way.

While the engine warmed up, I fastened the safety belt and made myself comfortable in the tiny fabric-and-tubing seat. My shoulders touched each side of the cockpit and I had to use my right hand to operate the trimming device beside my left shoulder. The vertical throttle handle is on the left side of the cockpit, just ahead of the trim handle (they interfere with each other once in a while, especially during landing approaches). The rudder pedals and toe brakes are conventional and are at the forward end of two small tunnels into which you slide your feet, one on each side of a large bulge that sticks up into the cockpit just ahead of the control stick. The retractable nose wheel fits into that bulge.

The control stick is small and fairly short. Both it and the rudders are very easy and sensitive to operate. The plane is easily steered on the ground by gentle use of the brakes.

The entire cockpit interior is pretty bare. There is no soundproofing. All the tubing and controls stick out in the open and only the minimum required instruments are on the panel. The Plexiglas hatch slides on runners and can be locked in any one of three positions at the discretion of the pilot. At about 2,000 engine r.p.m. the hatch on the airplane I flew set up such a racket I instinctively ducked; the whole airplane vibrated at that power. But once you get the engine running a little faster, the vibration settles back to normal and is much less.

The gas tank is behind your head and holds 7 gallons and 6 pints of 80 octane fuel. There's a glass-tube float gauge just behind your head, on the front end of the tank. The tiny baggage compartment is back there too; it holds a maximum of 20 pounds. The fuel cut-off valve is on the left wall of the cockpit, just ahead of the throttle handle. Mooney has rigged it rather ingeniously so that the valve—if it's accidentally left off—is bumped into the "on" position by the throttle when it is pushed to the wide-open position.

Once you've checked all these things you're ready for take-off. Because you've kept the carburetor heat on all during the warmup (it's standard procedure), you must be especially sure that you push it off before take-off. Other than that, all you do is shove the handle up against the instrument panel and steer the plane down the runway with the rudder. You must be especially careful not to leave your toes accidentally on the brakes. Best thing is to rest your heels on the floor, steering lightly with the bottom of the rudder pedals.

MOONEY M-18

Type Certificate No. 803
One liquid-cooled Mooney (Crosley) 25-h.p. engine.

Wing span	27 feet
Length	18 feet
Height	6 ft. 9 in.
Empty weight	460 pounds
Gross weight	700 pounds
Wing area	95 sq. ft.
Wing loading	7.4 lbs. sq. ft.
Top speed	100 + m.p.h
Cruising speed	85 m.p.h.
Stalling speed	44 m.p.h.
Maximum range	460 miles
Rate of climb (sea level)	400 + f.p.m
Service ceiling	10,500 + feet
Absolute ceiling	14,000 feet
Fuel capacity	7¾ gals.
Baggage	20 pounds
Design structural load factor	4.4 G

Source: Mooney Aircraft, Inc., Wichita, Kan.

Considering the racket the engine makes when it's wide open, you get the impression this little airplane is all set to leap high into the air as soon as you open the throttle. Instead, it just starts rolling, picking up speed slowly. After a while I started pulling the nose wheel off with the air speed reading about 40 m.p.h. Pretty soon the back wheels came off too, and I quickly dipped the nose to pick up whatever additional speed I could get so as to accelerate the climb. But then I found that you must get the gear up in a hurry because it too takes a large slice out of the take-off performance. That's where I had my first trouble.

As I've said, the gear is operated manually and is fitted with a counter weight to make it easier for the pilot to pull up all that weight with one lever. That lever is pretty much like a straight flap handle. The hand-grip moves up and down on the main handle and is spring loaded. In the down position, the handle is forward and the spring-loaded handle has its tip snapped into a hole under the instrument panel; that locks it into the forward position.

As soon after take-off as possible you must reach under the panel, grab that handle, push down to release the tip from the hole, then haul back. When you get the handle all the way back, and the tip hooked into another hole alongside your right leg, the gear is up and locked. But I had quite a bit of trouble with this mechanism. Either the slipstream is responsible or the counter weight wasn't installed properly. In any case, I had such a tussle getting the gear retracted immediately after take-off I was afraid I'd accidentally let the ship dive into the ground. Yet you don't dare leave the gear down until you gain altitude, as you would with another plane. That extended gear takes too much away from the Mooney's performance, so you simply must get it up immediately, no matter how difficult. I can well imagine how my take-offs looked from the ground, as I ducked my head down to reach the gear lever, then cussed and sweated the thing into the up-and-locked position.

For safety's sake I think that particular feature should be changed. The gear-operating mechanism must be easier to operate and it must not force the pilot to pull his head down into the cockpit—particularly just a few seconds after the ship has left the ground and is still critically low both in altitude and speed.

Once in the air, with the gear retracted and the plane trimmed for level flight, the Mooney is delightful to fly. It's very sensitive to its controls; you can really "think" this airplane around the sky.

Maneuverability and stability are outstanding for so small an airplane. Despite the strong, gusty wind which had lightplane training craft grounded and tied down, the Mooney performed beautifully and revealed no unpleasant tricks. Except, of course, for that icing engine mentioned earlier. I was flying back to the Mooney airport at about 1,000 feet when the engine suddenly started to run down. Even though I slammed the throttle wide open and pulled full heat on, it kept on going down. I had already picked a smooth field to land in and was turning toward it when the engine slowly began to regain its power. Luckily the Mooney people had warned me to look out for icing; if they hadn't, I surely would have had a forced landing.

This characteristic is something Mooney is going to have to work out of his plane. Inexperienced private pilots have enough trouble with carburetor ice as it is, and this airplane, after all, is intended for the rank amateur.

With its low wing loading (7.4 lbs. per sq. ft.) and its low gross weight (700 pounds), the Mooney bobs around a bit in rough air. I had no trouble in normal flight but I had no luck whatever in getting maximum rate of climb. One climb I timed came out to 180 f.p.m., another came to just over 200. The best rate of climb the CAA could get during its tests at that altitude was barely over 400 f.p.m. At 2,000 feet the official rate is just over 300 f.p.m.

The Mooney has an excellent stall. There is a slight shudder at between 40 and 45 m.p.h. indicated but that's all. It doesn't even drop its nose sharply, just a gentle mush, with plenty of control. I made several tight turns at low speeds and the same slight burble gave me plenty of warning.

Cruising true air speed at 3,600 r.p.m. (1,800 propeller r.p.m.) is 80 m.p.h. Maximum-range cruise is at 75. Never-exceed speed is 120 indicated. Bill Taylor, Mooney test pilot, flew an M-18 from Little Rock, Ark., to Tampa, Fla. (900 miles) in nine hours, with a 10 m.p.h. average tail wind. On another trip he flew one 1,680 miles and got an average speed of 85 m.p.h. What's more phenomenal than anything else, of course, is the fuel consumption at those speeds: on the 1,680-mile trip Taylor averaged 1.55 gals. per hour. Other Mooney figures show the plane gets about 60 miles to the gallon and can be flown for between 45 and 59 cents per 100 miles, the cost of gas and oil.

First thing you do in preparing to land is to pull the carburetor heat on; the sooner the better. Then crank the trim handle back. For about three-quarters of the way back, the handle just operates the tail group (the whole tail moves up and down). That slows the ship down. Then you release the catch on the landing gear, let it drop down, then make very sure that the spring catch is carefully locked in the forward position. Then crank the trim back the rest of the way, which automatically gives the maximum tail-down position and at the same time drops the maximum flap (16.5°). This is basically the same system as that used

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each wing tip. This big plane has thin, sharply swept-back wings with a 116-foot span. The Martin XB-48 has a 108-foot span and is also powered by six jet engines. It can carry over 10 tons of bombs for medium ranges.

The Northrop YB-49 is the jet version of the gigantic B-35 flying wing and has eight jet engines which propel it over 500 m.p.h. It has a 172-foot wingspan and probably weighs over 200,000 pounds fully loaded. Air Force officials are said to be extremely optimistic about its use as a long range jet bomber. There have been rumors about a projected Martin XB-51 and Convair XB-53, both presumably cancelled. The latter would have been especially interesting, since it was to have swept-forward wings.

Propeller-Jet Combinations

Propeller-jet combinations take several forms. They all have jet engines in the rear—but may have either piston engines or gas turbines driving propellers in the nose.

The Consolidated XF-81 had a "prop-jet" or gas turbine driving a propeller in the nose. This plane was designed to have a 2,500-mile combat range and a 500-m.p.h.-plus speed. The Ryan XF2R-1 had a General Electric gas turbine to drive the propeller through gears and another GE turbo-jet for rear thrust. The gas turbine-propeller problem has been proving more difficult than originally anticipated, however, mainly because of the difficulty of gearing down high turbine speeds to propeller speeds. A third in this group is the Boeing XB-52, a giant bomber scheduled to use new Wright turbo-props. Another projected Navy fighter using turbo-props is the Convair XP5Y-1, a fast flying boat.

More common are the piston engine-jet combinations, all of them Navy planes. The Grumman XTB3F, still in development, is a torpedo bomber with a piston engine in the nose and a jet in the tail. The Lockheed XP3V is a turbo-jet and propeller version of the *Neptune*. Two fighters are the Ryan *Fireball* (FR-1) and the Ryan XFR-4, the latter with better than 500-m.p.h. speeds. There is also a long-range patrol plane, the Martin P4M-1, which has piston engines in the front of each of its two nacelles and Allison jets in the rear. It is a land-based plane designed for sea patrol duty.

These are virtually all of the new U.S. jets. Air Force propeller-driven fighters are being replaced as rapidly as possible. The Navy is not converting so rapidly because jets are more difficult to operate off carriers but these problems are rapidly being solved.

Jet bombers, though, are more experimental. For at least the next two years, and probably longer, the Boeing B-50 will be our standard heavy bomber, supplemented by modified B-29s. But both are interim airplanes for the very simple reason that jet bombers are 200 m.p.h. or more faster.

Design Problems

The jets will take over as experience is gained in design and production. Problems in each are not fully known. The wing skin of the Bell X-1, for example, could not be built out of ordinary aluminum sheet and riveted onto framework as in the planes of World War II. It had to be machined out of heavy stock. Even so, after nearly two years of testing, this plane has not begun to approach the maximum speed at which its rocket motors are capable of driving it.

Despite the great gains that have been made in 10 years of jet engine development, and the present limits of structural strengths which restrict aircraft speeds, the search is on for more and more power. Higher speed is not the only goal; faster take-off and better altitude characteristics are also necessary. Better compressors would increase range materially. A jump of pressure ratio from four to 25 at a turbine inlet temperature of 1540° would add 45 per cent to the range of present jet fighters cruising 500 m.p.h. at 30,000 feet.

Better metals to increase operating temperatures also would add to efficiency and performance. Metallurgists are experimenting with such rare metals as zirconium, tantalum and stellite for turbine blades. They combine high strength with ability to resist corrosion, and alloys made with them might well be revolutionary.

It has always taken four or five years for a new airplane model to be designed, built, tested, and put into quantity production. During World War II the United States did not have in combat a single airplane the design of which was not in existence at the start of the war. The difficulties of design and construction are compounded with the new jet planes. The days when unskilled laborers could be taught to build aircraft in a few weeks are over—the skilled machine work now required often takes years of training.

Fortunately, Congress has appropriated enough funds to finance sufficient new planes to maintain and build up these necessary skills. Large amounts have been made available for research, for testing, and for pilot orders. The biscuit-cutting days of warplane construction and the rule-of-thumb days of design are long past. Today both are precision jobs. END

WAR IN FLORIDA

NAMORO declared war on Deluvia at Eglin Field, Fla., recently.

The two hypothetical nations battled each other in a series of five weekly exercises directed by the Ninth Air Force, and called "Operation Combine III." The maneuver demonstrated to over 3,500 service school students the technique of large scale air-ground attacks, and involved planes and men from the Navy, Army, Marine Corps and Air Forces.

Five hundred planes, 100 of them jets, and 8,500 men (including some 484 paratroopers) took part in the October maneuvers.

Highlight of each of the weekly exercises was a giant aerial demonstration directed by means of extensive radar and radio facilities of the Ninth Air Force's Tactical Air Control Center at Eglin Field. On one of the typical demonstrations, over 41 aerial missions were coordinated and flown in slightly over 3 hours, without deviation from a minute-by-minute schedule.

Photos show (top) some of the 484 paratroopers who jumped during the maneuvers. These troopers were members of the famed all-Negro Third Battalion of the 82d Division.

Small photo shows one of the demonstrations in which students from armed service schools were taught how to coordinate air-ground attacks.

Mooney M-18

(*Continued from page* 39)

3,900 for take-off. Mooney's present plan is to set up an arbitrary 250-hour replacement period for all power plants that go out in these little planes. He's setting the figure at 250 hours just to see how this equipment wears in the hands of average users. He feels that 1,000-hour replacement will eventually be common. For the time being, though, he wants to take back each power plant unit after 250 hours, exchanging it for a new one that will be installed in the customer's plane. Mooney's main concern is to make a careful check on the lubrication of the propeller-drive bearings, the one thing that actually caused trouble in early tests.

For all its modification, the engine is quite heavy: four pounds per horsepower. Reason, of course, is that it is basically an automobile engine with few of the lightweight, though expensive, aircraft parts. The Tillotson carburetor is the same as that on the automobile engine. So are the ignition system, the spark plugs—even the liquid-cooling system, which carries 1.8 quarts of coolant (40 per cent Prestone or Zerex, the rest water; this mixture is used the year-round).

Because the power plant unit is by far the heaviest part of this tiny plane, it contributes more than anything else to the plane's unsatisfactory take-off performance. The Mooney M-18 has been licensed with a power loading of 28 pounds per horsepower — considerably higher than any other personal plane I know of. That compares, for instance, with the *Bonanza's* power loading of just over 14 pounds per horsepower. After flying this airplane for more than an hour, I couldn't help think of the performance this excellent little airplane might have if it had a higher-horsepower aircraft engine which could be installed for the same weight. But the reason this hasn't been done is simply cost; while Mooney could probably double the horsepower for the weight, the cost would increase tremendously.

The fact remains, however, that the M-18 does have critical take-off performance. I don't recall ever having spent so much time getting a plane off the ground. A couple of times it took me over 15 seconds to get off of a macadam runway and into a 20 m.p.h. cross wind. Some of this was due to my inexperienced handling of the very sensitive controls. But even when the plane is flown by a company pilot it takes quite a while to get airborne. Factory specifications say the ship will get off in 600 feet. The CAA performance figures for the airplane taking off and climbing 50 feet, at the altitude and temperature at which I flew this airplane, call for a distance of nearly 2,400 feet.

And because this take-off performance is so critical, anything and everything affects it. There's a pronounced difference between a take-off from a hard-surfaced runway and from a grass field, with the grass slowing take-offs percep-

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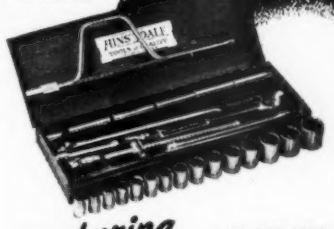

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tibly. Despite the strong wind that blew during the time I was flying this airplane, I never timed a take-off at less than 15 seconds—which compares with a number of four-second take-offs I made with an 85-h.p. Taylorcraft in a 10-m.p.h. wind just two days earlier. . . . But I'm getting a little ahead of myself.

You can't very well get checked out in a one-place airplane. So you just climb in, a pilot shows you the various controls, knobs and buttons, tells you how to use them, and that's that. The Mooney people wanted to make sure I knew how to operate the retractable landing gear, however, so a couple of men lifted the wings, put a sawhorse under each, one man held the tail down, and I was ready to try the gear a couple of times. This gear is retracted manually; there's no electric motor or hydraulic pump to help you. There's a counterbalancing weight somewhere in the mechanism which is supposed to make it easy for the pilot to retract the gear quickly after take-off.

So aside from getting a chance to work the gear a couple of times on the ground, you don't get a chance to feel out this airplane until you fly it. I was shown how to operate the simplified trimming device (very much like Mooney's Simpli-Fly system on the Culver V), the engine and flight controls, and then I was on my own.

The engine doesn't have a starter so I held the brakes while a man cranked the prop. The engine starts up with a roar and immediately starts running so fast you think you're over-revving it. But one look at the slow-turning prop is enough to remind you that the engine is supposed to sound that way.

While the engine warmed up, I fastened the safety belt and made myself comfortable in the tiny fabric-and-tubing seat. My shoulders touched each side of the cockpit and I had to use my right hand to operate the trimming device beside my left shoulder. The vertical throttle handle is on the left side of the cockpit, just ahead of the trim handle (they interfere with each other once in a while, especially during landing approaches). The rudder pedals and toe brakes are conventional and are at the forward end of two small tunnels into which you slide your feet, one on each side of a large bulge that sticks up into the cockpit just ahead of the control stick. The retractable nose wheel fits into that bulge.

The control stick is small and fairly short. Both it and the rudders are very easy and sensitive to operate. The plane is easily steered on the ground by gentle use of the brakes.

The entire cockpit interior is pretty bare. There is no soundproofing. All the tubing and controls stick out in the open and only the minimum required instruments are on the panel. The Plexiglas hatch slides on runners and can be locked in any one of three positions at the discretion of the pilot. At about 2,000 engine r.p.m. the hatch on the airplane I flew set up such a racket I instinctively ducked; the whole airplane vibrated at that power. But once you get the engine running a little faster, the vibration settles back to normal and is much less.

The gas tank is behind your head and holds 7 gallons and 6 pints of 80 octane fuel. There's a glass-tube float gauge just behind your head, on the front end of the tank. The tiny baggage compartment is back there too; it holds a maximum of 20 pounds. The fuel cut-off valve is on the left wall of the cockpit, just ahead of the throttle handle. Mooney has rigged it rather ingeniously so that the valve—if it's accidentally left off—is bumped into the "on" position by the throttle when it is pushed to the wide-open position.

Once you've checked all these things you're ready for take-off. Because you've kept the carburetor heat on all during the warmup (it's standard procedure), you must be especially sure that you push it off before take-off. Other than that, all you do is shove the handle up against the instrument panel and steer the plane down the runway with the rudder. You must be especially careful not to leave your toes accidentally on the brakes. Best thing is to rest your heels on the floor, steering lightly with the bottom of the rudder pedals.

MOONEY M-18

Type Certificate No. 803
One liquid-cooled Mooney (Crosley) 25-h.p. engine.

Wing span	27 feet
Length	18 feet
Height	6 ft. 9 in.
Empty weight	460 pounds
Gross weight	700 pounds
Wing area	95 sq. ft.
Wing loading	7.4 lbs. sq. ft.
Top speed	100 + m.p.h
Cruising speed	85 m.p.h.
Stalling speed	44 m.p.h.
Maximum range	460 miles
Rate of climb (sea level)	400 + f.p.m
Service ceiling	10,500 + feet
Absolute ceiling	14,000 feet
Fuel capacity	7¾ gals.
Baggage	20 pounds
Design structural load factor	4.4 G

Source: Mooney Aircraft, Inc., Wichita, Kan.

Considering the racket the engine makes when it's wide open, you get the impression this little airplane is all set to leap high into the air as soon as you open the throttle. Instead, it just starts rolling, picking up speed slowly. After a while I started pulling the nose wheel off with the air speed reading about 40 m.p.h. Pretty soon the back wheels came off too, and I quickly dipped the nose to pick up whatever additional speed I could get so as to accelerate the climb. But then I found that you must get the gear up in a hurry because it too takes a large slice out of the take-off performance. That's where I had my first trouble.

As I've said, the gear is operated manually and is fitted with a counter weight to make it easier for the pilot to pull up all that weight with one lever. That lever is pretty much like a straight flap handle. The hand-grip moves up and down on the main handle and is spring loaded. In the down position, the handle is forward and the spring-loaded handle has its tip snapped into a hole under the instrument panel; that locks it into the forward position.

As soon after take-off as possible you must reach under the panel, grab that handle, push down to release the tip from the hole, then haul back. When you get the handle all the way back, and the tip hooked into another hole alongside your right leg, the gear is up and locked. But I had quite a bit of trouble with this mechanism. Either the slipstream is responsible or the counter weight wasn't installed properly. In any case, I had such a tussle getting the gear retracted immediately after take-off I was afraid I'd accidentally let the ship dive into the ground. Yet you don't dare leave the gear down until you gain altitude, as you would with another plane. That extended gear takes too much away from the Mooney's performance, so you simply must get it up immediately, no matter how difficult. I can well imagine how my take-offs looked from the ground, as I ducked my head down to reach the gear lever, then cussed and sweated the thing into the up-and-locked position.

For safety's sake I think that particular feature should be changed. The gear-operating mechanism must be easier to operate and it must not force the pilot to pull his head down into the cockpit—particularly just a few seconds after the ship has left the ground and is still critically low both in altitude and speed.

Once in the air, with the gear retracted and the plane trimmed for level flight, the Mooney is delightful to fly. It's very sensitive to its controls; you can really "think" this airplane around the sky.

Maneuverability and stability are outstanding for so small an airplane. Despite the strong, gusty wind which had lightplane training craft grounded and tied down, the Mooney performed beautifully and revealed no unpleasant tricks. Except, of course, for that icing engine mentioned earlier. I was flying back to the Mooney airport at about 1,000 feet when the engine suddenly started to run down. Even though I slammed the throttle wide open and pulled full heat on, it kept on going down. I had already picked a smooth field to land in and was turning toward it when the engine slowly began to regain its power. Luckily the Mooney people had warned me to look out for icing; if they hadn't, I surely would have had a forced landing.

This characteristic is something Mooney is going to have to work out of his plane. Inexperienced private pilots have enough trouble with carburetor ice as it is, and this airplane, after all, is intended for the rank amateur.

With its low wing loading (7.4 lbs. per sq. ft.) and its low gross weight (700 pounds), the Mooney bobs around a bit in rough air. I had no trouble in normal flight but I had no luck whatever in getting maximum rate of climb. One climb I timed came out to 180 f.p.m., another came to just over 200. The best rate of climb the CAA could get during its tests at that altitude was barely over 400 f.p.m. At 2,000 feet the official rate is just over 300 f.p.m.

The Mooney has an excellent stall. There is a slight shudder at between 40 and 45 m.p.h. indicated but that's all. It doesn't even drop its nose sharply, just a gentle mush, with plenty of control. I made several tight turns at low speeds and the same slight burble gave me plenty of warning.

Cruising true air speed at 3,600 r.p.m. (1,800 propeller r.p.m.) is 80 m.p.h. Maximum-range cruise is at 75. Never-exceed speed is 120 indicated. Bill Taylor, Mooney test pilot, flew an M-18 from Little Rock, Ark., to Tampa, Fla. (900 miles) in nine hours, with a 10 m.p.h. average tail wind. On another trip he flew one 1,680 miles and got an average speed of 85 m.p.h. What's more phenomenal than anything else, of course, is the fuel consumption at those speeds: on the 1,680-mile trip Taylor averaged 1.55 gals. per hour. Other Mooney figures show the plane gets about 60 miles to the gallon and can be flown for between 45 and 59 cents per 100 miles, the cost of gas and oil.

First thing you do in preparing to land is to pull the carburetor heat on; the sooner the better. Then crank the trim handle back. For about three-quarters of the way back, the handle just operates the tail group (the whole tail moves up and down). That slows the ship down. Then you release the catch on the landing gear, let it drop down, then make very sure that the spring catch is carefully locked in the forward position. Then crank the trim back the rest of the way, which automatically gives the maximum tail-down position and at the same time drops the maximum flap (16.5°). This is basically the same system as that used

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on the Culver V; both flaps and trim are interconnected.

Mooney has added another novel gadget to the M-18. Once it's trimmed for landing a conventional airplane will suddenly go into a steep climb if the throttle is opened to any great degree. Mooney, however, has added a spring interconnection with the trim system on the M-18 so that, no matter how the airplane is trimmed, the throttle can be opened and closed suddenly without any drastic change in the plane's flight attitude.

Despite the small amount of flap, the M-18 has a fairly steep descent. You simply point it at the spot on which you want to land, then sit back and wait. Normal glide is 57 m.p.h.

The Mooney's landing characteristics —especially with that 20 m.p.h. wind— are breath-taking. I had just gotten a green light from the control tower and headed for the end of the long runway. As I crossed a low fence just behind the run-up circle at the end of the runway I eased back on the stick. Suddenly, almost before I could realize what had happened, I was standing still. I'll bet I didn't roll two plane-lengths before stopping. I did the same thing several times later, and it was quite common to be landed and stopped within the diameter of the run-up circle at the end of the runway. This little plane's landings are as good as its take-offs are poor.

Although Mooney does have his CAA certificate (No. 803), he has not put this little plane on the market. To date he has produced about six, and each has gone to an operator who has agreed to participate in a market-research program. There is one M-18 in California, another in Florida, one in Kansas, and one in Ohio. Another is scheduled to go to New York shortly. Each of these airplanes is being flown by a wide variety of pilots and their comments are being sent back to the factory. Mooney is using this program to determine if there is enough interest in a one-place airplane to justify going into production as well as to work out the bugs.

It remains to be seen whether there is a market for such a plane. With the present limited production, the plane would have to sell for $2,050. Mooney wouldn't want to market it at all unless he could get the price down to $1,650, at least.

Unfortunately, the present used-plane market is pretty well loaded with good buys in that price range. And it's still debatable whether a one-place airplane would sell even under ideal conditions.

Meanwhile, Mooney is hard at work taking some of the bugs out of this intriguing little ship. High on his priority list is the take-off performance. Once that problem is licked he should find hundreds of enthusiastic followers. Personally, I would like very much to have one of these flying motorcycles for fast, economical travel in the vicinity of Washington. END

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946.

Of Flying, Published Monthly at Chicago, Ill. for Oct. 1, 1948

State of Illinois, } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Arthur T. Pullen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of Flying and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publishers, William B. Ziff, 185 North Wabash Ave., Chicago, Ill.; Editor, William B. Ziff, 185 North Wabash Ave., Chicago, Ill.; Managing editor, Curtis Fuller, 185 North Wabash Ave., Chicago, Ill.; Business manager, A. T. Pullen, 185 North Wabash Ave., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and adderesses of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is ..... (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

ARTHUR T. PULLEN,
Business Manager.

Sworn to and subscribed before me this 28th day of September, 1948.

[SEAL] EVELYN BYLICA,
Notary Public.

(My commission expires April 24, 1950.)

Flying the Jet

(*Continued from page* 29)

pecially at altitude. As a jet pilot, seeking to fly long distances, you will therefore fly at high altitude. You will cruise at higher speeds. And you will allow a greater fuel reserve for landing under bad conditions because your fuel consumption will be exceptionally high when you are maneuvering for landings at low altitude. It takes about 40 gallons of fuel to go around the field once.

Our new fighters have dive flaps, but one of the most difficult problems in flying the early jets was descending from altitude. On the Bell F-59, the throttle was almost all the way back at 40,000 feet and it was very difficult to get down to 30,000 feet without building up dangerously high speeds.

When you take a propeller-driven plane and point its nose downward, you get a very high braking thrust from its idling propeller—especially if you can keep the idling r.p.m.'s high. In fact you can descend at a rate of maybe one to three—that is, covering three miles horizontally for every mile of descent—and still not exceed dangerous speeds.

You just can't do that with a jet unless you use dive flaps. Aerodynamically it is too clean. Besides, you don't have a propeller to give braking action. No matter how slow you idle your jet engine, it is always giving you some additional thrust. So if you try to come down at an angle of more than 1 to 10 you are likely to run into critical speeds. A good many accidents have been caused by this fact. With dive flaps, however, you can come down safely just as fast as you can take it—10,000 feet a minute if you have to. It's a strange thing but your plane keeps under good control with these dive flaps, and they don't seem to cause too much drag at slower speeds.

Spinning? It was a problem at first, but when more fin was added to some of the planes, they could recover from spins. The F-80 has excellent spin recovery, except with full wing tip fuel tanks—and they can be jettisoned easily if you are in trouble. Recovery in the F-80 usually can be made in half a turn.

Landing is a question of good judgment. You want to keep your thrust as low as you can, but still you want to keep your r.p.m.'s high enough so that you can get out of there if your judgment is bad. You're always going to have some thrust; your jet engine is feeding it out and that propeller isn't there to brake your speed. If your runway is long, you don't have much to worry about. But one of the troubles with jets is that they don't give you that last minute quick spurt of power that you may need.

The problem here is two-fold. First, remember that at low speed your jet thrust isn't as efficient as at high speed. Second, it may take as long as 12 to 15 seconds for your turbine to accelerate to full power. That's several times as long as reciprocating engines require. You just don't have that quick horsepower ready to roar into instant action and pull you out of a hole.

As a consequence, you may land with more thrust than you would care to, and you throttle the engine way back only as you touch down. Your flaps, meanwhile, are fully extended, but if you have to get up and get out of there you're always ready to pull them up as fast as you can and jam on full throttle.

The first conclusion you will draw from this is that landing jets, either on carriers or on the ground, is much tougher than landing reciprocating-engined planes of the same general wing loading. That's only half-true, however.

The other side of the picture is that both conventional and jet fighters approach at about the same speed—say 120 m.p.h. And at low speeds, jets have all the advantage because they have no torque problems. Landing an F-51, for example, you can hardly hold it if you have to give it full throttle to go around again. You just don't have enough rudder. If you start to ground loop and give an F-51 throttle, then you're just gone, brother. But you don't have these torque problems with a jet and it's a lot smoother and surer to handle because of that fact. On the ground, however, jets are harder to steer and taxi. You don't have a prop blast over the rudder to steer them effectively.

In switching over to jets, the pilot will have to understand the differences between this new, cleaner and more powerful airplane and the now obsolete fighter or bomber he is leaving behind him. He has stepped over an invisible line. He is in a realm new and strange to him. He is bound to be more nervous and unsure of himself, just as anyone is in a new type of plane. The invisible line is bounded by known limitations as far as conventional aircraft speed and performance is concerned. There are not yet any such limitations for jets.

Jets are just like any new machine. As they are used they will become more reliable. Present manual controls will become automatic. They will become simpler. Development is just beginning; supersonic speeds will soon be commonplace. From there on, who knows what demands will be made upon the jet pilot and his airplane? END

The Mail Box

(*Continued from page 6*)

catch on to the fact that even in the most anxious moments there are split seconds when the mind flashes to the little things. In Herb Fisher's case it was the Saturday "pot roast." How I chuckled.

Congratulations on a brilliant thumbnail sketch—and thanks for continuing a series of articles which helps fellow pilots avoid the same mistakes.

CHARLES W. CAIN

Washington, D.C.

● Noted aeronautical journalist Charles Cain of England is chairman of "Air-Britain" and former editor of "The Aeroplane Spotter."—ED.

DIFFERENT ENGINES

In your July issue ("Surplus Planes—A Bargain") you call a BT-15 a BT-13. I'm pretty certain a BT-13 has a Pratt & Whitney engine and that a BT-15 has a Wright engine, like the trainer you picture. Am I right?

LUTHER JOE LYBUS

Vernon, Tex.

● You're right. The BT-13 had a 450 h.p. Pratt & Whitney; the BT-15 shown in FLYING had a 440 h.p. Wright engine.—ED.

DEFENSE OF THE JENNY

Subject: "Curse of the Jenny" in September FLYING.

The Bollinger & Tully space-filler is a neat attempt. The arrangement of meaningless, many-worded paragraphs is intended, doubtlessly, as another Harvard classic.

Second-run photos fail to aid the Harvard space-filler data jockeys: and it will be interesting to know when the dust has settled in the rush for the new text, "Personal Aircraft Business at Airports."

One side, Bollinger & Tully, you are standing in your own prop wash!

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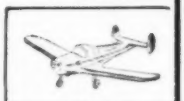

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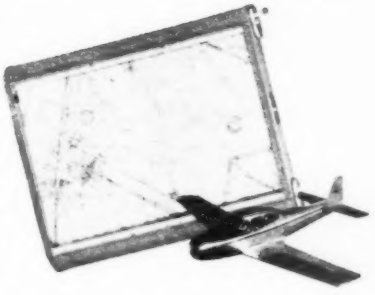

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